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# Poster Display II Clinical General

14:00-18:00

5.1

**The influence of combined therapy with perindopril and trimetazidine on the silent myocardial ischemia and on left ventricular remodeling in essential hypertension.** S.V. Svetlana Gurgenyani<sup>1</sup>, S.K.H. Vatinyan<sup>2</sup>, K.G. Nikogosyan<sup>3</sup>, L.B. Edilyan<sup>2</sup>, B.G. Chobanyan.<sup>2</sup> <sup>1</sup>Institute of Cardiology, Arterial hypertension, Yerevan, Armenia, <sup>2</sup>Institute of Cardiology, Arterial hypertension, Yerevan, Armenia, <sup>3</sup>Institute of Cardiology, Arterial Hypertension, Yerevan, Armenia

**Objective:** To assess the effects combined therapy of inhibitor ACE, perindopril (P) and metabolic anti-ischaemic agent, trimetazidine MR (T) on the parameters of myocardial ischaemia and on dynamic of left ventricular (LV) remodelling in hypertensive patients (pts).

**Design and Methods:** We studied 36 pts with BP  $\geq 160/100$  mm Hg (22 male and 14 female, average age  $51.4 \pm 3.7$  years) and with LV hypertrophy and silent myocardial ischaemia estimated by changes in wall motion score index (WMSI) at rest and at peak of the dobutamine stress-echocardiography (SE). The pts were randomized into two groups by 18 in each: I-was administered P (4-8 mg o.d.) and T (35 mg t.d.); II -P in same dose and placebo. Echocardiography and SE were performed at baseline and after 6 months of treatment.

**Results:** BP fell less than 140/90 mm Hg in all groups. LV hypertrophy regression was observed in I and II groups by 83.3% and 77.8% accordingly. The WMSI was substantially improved at rest and at peak of the SE in the responders to regression and more pronounced in I group compared with II group: I-from  $1.44 \pm 0.02$  to  $1.29 \pm 0.01$  at rest and from  $1.72 \pm 0.02$  to  $1.52 \pm 0.01$  at peak of SE ( $p < 0.001$ , for each) II-from  $1.41 \pm 0.03$  to  $1.31 \pm 0.02$  at rest and from  $1.69 \pm 0.04$  to  $1.58 \pm 0.03$  at peak of SE ( $p < 0.05$ ). Simultaneously with LV hypertrophy regression and reduction of myocardial ischaemia parameters there was observed the improvement of diastolic function more expressed in I group compare with II group: peak of velocity of early and late filling ratio (E/A) was increased in I-from  $0.95 \pm 0.03$  to  $1.26 \pm 0.02$  ( $p < 0.001$ ); in II-from  $0.94 \pm 0.02$  to  $1.16 \pm 0.03$  ( $p < 0.05$ ); the isovolumetric relaxation time was decreased in all groups: I-from  $137.5 \pm 0.03$  to  $103.1 \pm 0.08$  msec ( $p < 0.002$ ); II-from  $136.1 \pm 0.10$  to  $118.1 \pm 0.08$  msec ( $p < 0.05$ ).

**Conclusion:** Despite identical fall of BP and LV hypertrophy regression the combined therapy with P and T produces more pronounced reduction of myocardial ischaemia and restoration of LV function compare with monotherapy of P in hypertensive pts.

5.2

**Detection and quantification of silent ischaemia in essential hypertensives without or with type 2 diabetes mellitus by dipyridamole sestamibi myocardial imaging.** Y. Lacourcière<sup>1</sup>, M. Marcel Dumont<sup>1</sup>, J. Lefebvre<sup>2</sup>, L. Poirier<sup>2</sup>, C. Côté.<sup>1</sup> <sup>1</sup>CHUQ, Nuclear Medicine, Quebec City, Canada, <sup>2</sup>CHUL, Hypertension Division, Québec, Canada

**AIM** Coronary artery disease (CAD) is the leading cause of morbidity and mortality in hypertensive and hypertensive diabetic patients (pts). Early diagnosis of CAD and identification of high risk subgroups followed by appropriate therapy may therefore enhance survival. The purpose of this prospective study was to establish to what extent type 2 diabetes mellitus (DM) modifies the prevalence and severity of silent CAD in pts with essential hypertension (EH).

**Material and methods:** The study population consisted of 501 pts, >45 years, with EH (n = 298) and EH with type 2 DM (n = 203) without known CAD. Patients were selected according to the criteria defined by the American Diabetes Association (ADA). All pts underwent a 1 or 2-day stress protocol. Technetium-99m sestamibi dose was injected at rest after the administration of sublingual nitroglycerin and during a stress test using dipyridamole. Each stress and rest myocardial image was divided into 20 segments and was blindly analysed by two experienced observers for the presence and severity of perfusion defects using a 5 point scoring system.

The summed stress score (SSS) and the summed rest score (SRS) were obtained by adding the scores of the 20 segments of the stress and rest sestamibi images, respectively. The difference between SSS and SRS was defined as the summed difference score (SDS), an index of the severity of myocardial ischaemia.

**Results:** There was a significant difference ( $p = 0.001$ ) between the proportion of EH pts with (41.9%) and without DM (28.2 %) with regards to abnormal SSS. Moreover, the frequency of abnormal SDS was significantly ( $p < 0.001$ ) higher in EH pts with DM (40.4%) than in pts without DM (25.2%). Furthermore, there was a significantly greater severity of silent ischaemia in EH pts with DM ( $p = 0.001$ ).

**Conclusions:** The results of this prospective study using dipyridamole stress sestamibi indicate that silent CAD is rather frequent in EH pts. It is noteworthy that the prevalence and severity of silent ischaemia are much greater in EH pts with DM when screened according to ADA criteria.

5.3

**Prevention of coronary restenosis with liquid-filled 188Re balloon: preliminary results of an International Atomic Energy Agency (IAEA) multicenter study.**

A. Amalia Peix<sup>1</sup>, O. Alonso<sup>2</sup>, I.H. Chae<sup>3</sup>, J.K. Chung<sup>3</sup>, C. Gutierrez<sup>4</sup>, J. Kropp<sup>5</sup>, C. Onsel<sup>6</sup>, I. Silvani<sup>7</sup>, L. Llerena<sup>1</sup>, A.K. Padhy.<sup>8</sup> <sup>1</sup>Institute of Cardiology, Nuclear Medicine, La Habana, Cuba, <sup>2</sup>University of Uruguay, Nuclear Medicine Center, Montevideo, Uruguay, <sup>3</sup>Seoul Nat. University Hospital, Dept. of Int. Medicine and Nucl. Medici, Seoul, Korea, Republic of, <sup>4</sup>Fundacion Cardioinfantil, Instituto Cardiologia, Bogota, Columbia, <sup>5</sup>Technische Universitaet, Nucl. Medicine and Heart Center, Dresden, Germany, <sup>6</sup>Cerraphasa Medical Faculty, Dept. of Nuclear Medicine, Istanbul, Turkey, <sup>7</sup>Semmelweis University, Dept. of Nuclear Medicine, Budapest, Hungary, <sup>8</sup>IAEA, Nuclear Medicine Section, Vienna, Austria

Intravascular radiation therapy (IVRT) has been proved to reduce the restenosis rate after PTCA. In this context, IVRNT using a standard angioplasty balloon filled with 188Re-perrhenate can constitute a cost-effective, self-centering approach.

**Aim:** To evaluate the safety and effectiveness of this technique in the framework of a prospective, multi-center and multinational co-ordinated research project conducted by the International Atomic Energy Agency.

**Methods:** Eighty-one patients from 6 participating countries, with a mean age of 59 years (range: 36-81), with de novo (n=38) or in-stent restenosis (n=43) and proven ischemia were included. After successful PTCA with (n=13) or without (n=68) additional stent

implantation a second standard balloon was placed into the PTCA area and filled with 188Re-perrhenate at 3 atm. Irradiation time was  $388 \pm 176$  sec to achieve a dose of 18 Gy at 1 mm depth from luminal surface.

**Results:** Angiographic and clinical follow-up was available in 53 patients. In this group, the pre-procedural reference vessel diameter was  $2.7 \pm 0.5$  mm with a mean percent diameter stenosis of 59% (range: 36%-76%). At 6 months restenosis occurred at the target lesion in 11/53 cases (21%). No in-hospital major adverse cardiac events were documented. Three patients developed late thrombosis at 3 months, with subsequent myocardial infarction. An additional stent had been implanted in two of them. Target lesion revascularization was seen in two additional patients.

**Conclusions:** IVRT using 188Re liquid-filled balloons has thus been demonstrated as a feasible, safe and cost-effective therapeutic modality with the potential for effectively decreasing the incidence of restenosis following PTCA, which will be further evaluated in a larger patient group.

The authors thank Dr. F. F. Knapp (Oak Ridge National Lab, Oak Ridge, TN) for technical assistance.

5.4

**Mental stress-induced ischemia in women with angina and normal coronary angiograms.**

A. Amalia Peix<sup>1</sup>, D. Garcia-Barreto<sup>1</sup>, A. Trapaga<sup>2</sup>, L. Asen<sup>2</sup>, O. Infante<sup>2</sup>, F. Ponce<sup>1</sup>, L.O. Cabrera<sup>1</sup>, J. Valiente<sup>1</sup>, F. Tornes<sup>1</sup>, I. Guerrero.<sup>1</sup> <sup>1</sup>Institute of Cardiology, Nuclear Medicine, La Habana, Cuba, <sup>2</sup>Políclínica Plaza, Dept. of Psychology, La Habana, Cuba

Coronary heart disease (CHD) is frequent in postmenopausal women. Mental stress is associated with adverse events in patients with CHD, as well as silent myocardial ischemia detected by echocardiography and myocardial scintigraphy has been induced with mental stress testing.

**Aim:** To evaluate if mental stress can induce ischemia in women with typical angina and normal coronary arteriograms.

**Methods:** Sixteen patients were studied. All underwent technetium-99m methoxyisobutyl-isonitrile myocardial scintigraphy (protocol physical stress-rest-mental stress); endothelial function measured by ultrasonography at brachial artery and 24 hours ambulatory electrocardiographic recording (Holter).

**Results:** During mental stress testing, 5 patients (31%), mean age  $54 \pm 4$  years (Group I) had perfusion defects in the myocardial scintigraphy, while the other 11 patients (69%), mean age  $56 \pm 8$  years (Group II) did not. There was no significant difference regarding presence of hypertension or rest angina. Group I patients had more diabetes mellitus (40 vs 27%), stress angina (40 vs 9%) and endothelial dysfunction (80 vs 27%) than Group II. There was a concordance between perfusion defects induced by physical and by mental stress. Myocardial scintigraphy showed anteroapical / septal ischemia in four patients and inferoapical in one. Among Group II patients, only one patient had an anteroapical perfusion defect with physical stress, but not with mental stress. In 60% of cases the Holter recording was normal in Group I patients, while in Group II only two patients had alterations suggestive of ischemia.

**Conclusions:** In postmenopausal women with typical angina and normal coronary angiograms, there is an adequate concordance between the detection of ischemia induced by physical and by mental stress, as well as between mental stress-induced ischemia and presence of endothelial dysfunction.

## 5.5

### Nuclear cardiology in cardiac resynchronization therapy assessment.

A. Amalia Peix<sup>1</sup>, R. Zayas<sup>2</sup>, MA. Quiñones<sup>2</sup>, F. Ponce<sup>1</sup>, F. Tornes<sup>2</sup>, J. Castro<sup>2</sup>, Y. Fayad<sup>2</sup>, LO. Cabrera<sup>1</sup>, R. Carrillo<sup>1</sup>, A. De Paz<sup>1</sup> <sup>1</sup>Institute of Cardiology, Nuclear Medicine, La Habana, Cuba, <sup>2</sup>Institute of Cardiology, Electrophysiology, La Habana, Cuba

**Introduction:** Cardiac resynchronization therapy (CRT) by biventricular pacing is indicated in patients with severe heart failure and left bundle branch block who remain asymptomatic despite optimal medical therapy.

**Methods:** To assess the behavior of resting perfusion pattern and temporal parameters of ventricular synchronization baseline and after CRT using nuclear cardiology testings, fifteen patients (mean age: 58±8 years, 56% women) were included. All underwent radionuclide angiography (RNA) and resting gated single-photon emission computed tomography perfusion scan with technetium-99m methoxy-isobutyl-isonitrile before CRT and at 6-months follow-up. Left ventricular ejection fraction (LVEF), ventricular volumes and regurgitation index were calculated. In the RNA, the onset (To); mean time (Tm); total contraction time (Tt); final time (Tf) and propagation time (Tp) for right (RV) and left ventricle (LV); as well as total propagation time (TTP); interventricular time (TRV-LV), base-apex (TB-A) and septum-lateral wall (TS-LW) conduction times were measured on the 3H Fourier histogram of the time -- activity curve.

**Results:** One patient died before follow-up. In the remaining 14 patients there was a significant LVEF and RVEF increase after 6-months CRT (from 22±5 to 38±17% and from 34±9 to 43±10%, respectively). Diastolic function also improved and ventricular volumes decreased, but not significantly. Regurgitation index decreased from 1.91±0.3 to 1.5±0.1. LV started its contraction 52 ms before than baseline and the interventricular asynchronism reduced from 97±62 ms to 48±9ms. Intraventricular asynchronism (septum-lateral wall and apex-base) also decreased. This coincided with the clinical improvement. Regarding myocardial perfusion, although the coronary angiography was normal in all these patients, resting perfusion scoring decreased from 41±10 at baseline to 27±7 after 6-months CRT.

**Conclusion:** Nuclear cardiology testings are reliable methods for cardiac resynchronization therapy assessment.

## 5.6

### Left ventricular volumes in denervated human hearts. Is ejection fraction dependent on pre- and afterload?

J. Jesper Mehlsen, C. Hadersdal. Frederiksberg Hospital, Clinical Physiology, Frederiksberg, Denmark

The present study was aimed at an investigation of the relation between left ventricular preload, afterload, and contractility in patients autonomic dysfunction causing denervation of the heart and the arterial system.

Seven patients aged 69 years (49-84) with autonomic failure caused by multiple system atrophy, Parkinson's disease or progressive autonomic failure were included. Intra-arterial blood pressure and the electrocardiogram were recorded continuously and left ventricular volumes were measured in the supine position by multigated radioisotope ventriculography using 99mTc-labelled autologous red blood cells. Head-up tilt angles of 0, 25, and 45 degrees were used.

Left ventricular end-diastolic volumes (LVEDV) at the three tilt angles were 91, 61 and 41 ml, respectively (p=0.002) with stroke volumes at 59, 43, and 27 ml (p=0.002). Systolic blood pressures were 168, 128, and 105 mmHg (p=0.002). Left ventricular ejection fraction remained unchanged at 0.66, 0.71, and 0.68 (p=0.607). Heart rates were 79, 85, and 90 bpm (p=0.006) resulting in cardiac outputs of 4.6, 3.5, and 2.4 liter (p=0.002). Systemic vascular resistances remained unchanged (p=0.311). Systolic blood pressures correlated with LVEDV both for the group of patients (r=0.40) and for the individual cases (mean value of r<sup>2</sup> = 0.96).

This study shows that in patients with autonomic denervated hearts, ejection fractions remain unchanged in spite of profound changes in both pre- and afterload. It also shows that without autonomic innervation there is a close relationship between cardiac filling and arterial blood pressure.

## 5.7

### Comparative value of planar versus tomographic acquisitions for the calculation of left ventricular volume with ECG gated equilibrium radionuclide angiography.

D. Doumit Daou<sup>1</sup>, C. Coaguila<sup>1</sup>, A. Benada<sup>1</sup>, R. Lebtah<sup>2</sup>, I. Idy-Peretti<sup>1</sup>, D. Le Guludec<sup>2</sup> <sup>1</sup>Lariboisiere Hospital, AP-HP, Nuclear Medicine Dept, Paris, France, <sup>2</sup>Bichat Hospital, AP-HP, Nuclear Medicine Dept, Paris, France

**Aim:** Planar-RNA is a simple method for the calculation of left ventricular (LV) ejection fraction. With planar radionuclide angiography (planar-RNA), different methods with variable complexities have been reported for the calculation of LV end diastolic volume (EDV). One of these methods, the Massardo method is interesting because of its simplicity. It needs no additional images to be acquired, no blood counting, no attenuation nor decay correction. Similarly, SPECT RNA is a simple method that provides both EDV and end-systolic LV volumes and LV ejection fraction. We have previously validated its use for both LVEF and LV volume. We aimed to compare the accuracy of the Massardo method applied to planar-RNA to the maximum activity threshold method applied to SPECT RNA for the measurement of LV EDV.

**Methods:** Our population included 37 consecutive patients with CAD having planar-RNA (best septal view) followed by SPECT-RNA, and conventional contrast X-rays LV angiography within 1±3 days. Conventional contrast X-rays LV angiography (Dodge method) was used as the reference method for EDV. The Massardo method applied to planar-RNA to the maximum activity threshold method applied to SPECT RNA for the measurement of LV EDV.

**Results:** EDV calculated with X-rays, SPECT-RNA, and planar-RNA were respectively 207±69\*, 204±65\*, and 184±63\* (\*: p=0.021 and \*: p=0.004). EDV calculated with SPECT-RNA was better correlated than planar-RNA with X-rays EDV: X-rays = 40+0.82\*SPECT-RNA (r = 0.78; ser= 44 ml; p=0.0001) and X-rays = 79+0.70\*planar-RNA (r = 0.64; ser= 54 ml; p=0.0001). On Bland-Altman analysis, the absolute paired difference (mean±SD) for the SPECT-RNA and planar-RNA versus the X-rays reference method were respectively 3±45 ml and 24±56. As compared to the X-rays reference method, planar-RNA underestimated EDV. This underestimation was constant over the wide range of EDV evaluated. And there was no over or under estimation of EDV with SPECT RNA over the wide range of EDV evaluated. Note that the limits of agreement were wider with the planar-RNA than SPECT RNA.

**Conclusion:** As compared to planar-RNA (Massardo method), SPECT RNA (maximum activity threshold method) is more accurate for the calculation of EDV. Moreover, it provides EDV concordant with those of absolute X-rays EDV.

## 5.8

### Feasibility of gated SPECT radionuclide angiography for the assessment of inter and intra ventricular mechanical synchrony in biventricular stimulation.

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**Aim:** In chronic heart failure, the primary decrease in myocardial contractility is frequently combined to an abnormality in the sequence of myocardial electrical activation. This leads to dyssynchronism (D) in myocardial contraction (mechanical D). This latter combines to the primary decrease in myocardial contractility and deteriorates further more cardiac function. Biventricular stimulation has been proposed as a treatment of advanced heart failure. Planar radionuclide angiography (RNA) with Fourier phase analysis (FPA) has been proposed for the evaluation of mechanical D. But, planar RNA suffers from its 2-D nature imposing some difficulty in individualizing myocardial segments. SPECT RNA can obviate this limitation. We aimed to describe the potential applicability of FPA to SPECT RNA for the evaluation of mechanical D.

**Methods:** Our study included a control population (n=8 normal patients) to define normal limits of FPA for SPECT RNA, and one patient with primary dilated cardiomyopathy having a DDD pacemaker implanted 3 months earlier. This patient was well ameliorated by the DDD pacemaker (from NYHA-III to NYHA-I). In this patient, SPECT RNA was realized in the DDD mode and then 15 minutes after programming the AAI mode. SPECT RNA studies were processed with the maximal activity threshold method and FPA (one harmonic, phase expressed in degrees) of the time activity curves of each of 16 left ventricular (LV) segments was calculated. Intra and inter ventricular FPA (mean and standard deviation -SD- of global LV and global right ventricular -RV- phase, mean phase delay between LV/RV) and phase delay between LV septal and lateral (S/L) basal segments were calculated.

**Results:** In the control population, LV mean phase was 167±14° and LV SD phase was 5±1°. For the RV, these were 160±12° and 13±6°. LV/RV delay was 7±9° and LV S/L delay was 1±7°. In the patient with cardiomyopathy, we found for the LV in the AAI versus DDD mode respectively 171° versus 189° for the mean and 63° versus 71° for the SD. For the RV, these were 234° versus 213° for the mean and 75° versus 117° for the SD. For the LV/RV phase delay, these were -63° versus 88°. For the S/L phase delay, these were -41° versus 88°. Note the reduction in S/L phase delay and feasibility of quantifying the mechanical D of the LV and RV globally and between any LV and RV segments.

**Conclusion:** Quantification of intra and inter ventricular mechanical D before and after pacemaker implantation with FPA SPECT RNA is feasible. It is characterized by the objectiveness of its semi-automatic processing method.

## 5.9

### Mechanisms of regional wall motion abnormalities in contrast-enhanced dobutamine stress echocardiography.

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**Background:** In the diagnosis of coronary artery disease (CAD) with Dobutamine Stress Echocardiography (DSE), regional wall motion abnormalities (RWMA) are assumed to indicate a perfusion deficit.

**Methods and Results:** For a more particular examination of RWMA, we compared simultaneous echo-contrast (Optison®)-enhanced DSE (0-40mg/kg Dobutamine, 16-segment-model) and MiBi-SPECT in a prospective double blinded study design in 69 non-selected consecutive patients (44 male, 25 female, age 64±12 yrs.). Additionally, all patients were examined by coronary-angiography. The prevalence of significant CAD (stenosis >50% lumen diameter) was 52%. DSE had a sensitivity of 86% and a specificity of 68% for the detection of significant CAD with a positive and negative predictive value of 73% and 71%, respectively. The sensitivity and specificity of MiBi-SPECT were 78% and 84% respectively. Among 30 patients with significant CAD and positive DSE study (true positive), 77% displayed a corresponding perfusion deficit in MiBi-SPECT. Among 11 patients with a positive DSE study but no current significant coronary stenosis (false positive), 82% showed stress induced RWMA in the inferior/posterior region, 73% displayed left ventricular hypertrophy, 54% rest-ECG abnormalities and 45% displayed resting-RWMA (3 previous MI, 2 previous CABG surgery). Among 5 patients with negative DSE study but significant coronary stenosis (false negative), 80% had a stenosis of the LCX, 60% displayed resting-RWMA, 60% displayed left bundle branch block or ST-segment depression, 40% displayed only peripheral coronary stenosis.

**Conclusion:** This prospective study in non-selected patients shows that the majority of RWMA in DSE are matched to a perfusion deficit detectable by nuclear imaging. Nevertheless, pre-existing cardiac abnormalities may also lead to stress-induced RWMA not associated with a perfusion deficit or mask a perfusion deficit upon DSE.

## 5.10

### The combination of TI-201 scintigraphy and dobutamine stress echocardiography, increases the sensitivity for detection of viable myocardial tissue after myocardial infarction.

N.T. Nikos Kouris<sup>1</sup>, D.D. Kontogianni<sup>2</sup>, G.S. Goranitou<sup>2</sup>, M.D. Sifaki<sup>2</sup>, E.M. Kalikandi<sup>2</sup>, H.E. Grasso<sup>2</sup>, E. Papouli<sup>2</sup>, D.K. Babalis<sup>2</sup> <sup>1</sup>Athens, Greece, <sup>2</sup>Western Attica General Hospital, Cardiology Dept, Athens, Greece

TI 201 scintigraphy (TI) with reinjection and dynamic stress echocardiography (DSE) with dobutamine are both characterized by satisfactory sensitivity and specificity when used for the detection of viable myocardium after myocardial infarction (MI). The aim of our study was to clarify whether the sequential performance of both methods in the same patients (pts) provides additional information, capable of changing our therapeutic decisions as far as revascularization is concerned.

**Patients and methods:** Fifteen consecutive pts (12 male, 3 female), mean age 65±9 years and with a history of MI during the previous 13 months, underwent DSE for the detection of myocardial viability, followed by TI the day after. DSE was performed in two 3-min stages using low-dose dobutamine (5 and 10 µg/kg/min respectively), while TI SPECT study consisted of 3 stages (i.e. exercise, rest and redistribution phases, following reinjection of 1mCi of TI-201). Left ventricle was divided in 16 segments for the evaluation of wall motion abnormalities and perfusion defects. These segments were identical and comparable to those used during TI quantitative analysis (bull's eye), provided that apex itself belongs to apical segments. During DSE, myocardial segments were regarded to be viable if they were hypokinetic or akinetic but with improved contractility after dobutamine administration. During TI SPECT viable segments were those that demonstrated a reversible perfusion defect with or without TI reinjection (TI uptake>50% ROI).

**Results:** We studied a total of 240 myocardial segments (15 pts, 16 segments each); 108 segments (45%) demonstrated regional wall motion abnormalities (RWMA) on DSE; 27 of them (25% of the dysfunctional segments:ds) were viable (V). On TI SPECT 112 out of 240 segments (47%) had a perfusion defect; 39 of these defects (34% of ds) were V. When both methods were performed, 49 V segments were detected (36% of ds). Results were evaluated by the ANOVA test for repeated measurements. The percentage of viable segments detected by the combination of the two methods was found to be significantly higher than the percentage detected by DSE alone (p=0.025). On the contrary, no difference was found in the number of segments detected by the combination method and TI alone.

**Conclusion:** The sequential performance of DSE and TI SPECT is feasible and seems to increase the likelihood for the detection of myocardial viability after MI, particularly in cases that DSE alone fails to detect a satisfactory number of viable segments, capable of providing an indication for revascularization.

## 5.11

### LVEF by TI-201 Gated SPECT: Limits of normalcy and reproducibility.

E. Efstratios Moralis<sup>1</sup>, T. Spyridonidis<sup>2</sup>, G. Arsos<sup>1</sup>, K. Karakatsanis<sup>1</sup> <sup>1</sup>Hippokraton Hospital, Thessaloniki, Greece, <sup>2</sup>Rio Hospital, Patras, Greece

**Aim:** TI-201 Gated SPECT (TI-GSP) may be used in the calculation of left ventricular ejection fraction (LVEF).

This study investigates the normal lower limits of LVEF by TI-GSP. In addition, the limits of reproducibility of TI-GSP LVEF from two independent acquisitions per patient are assessed.

**Method:** Twenty-nine consecutive patients (23 male, 6 female), aged 55 ± 10 years, with low pre-test probability of coronary artery disease, with no history of other cardiovascular disease, and unequivocally normal TI-201 scans, were enrolled. Patients were submitted to routine symptom limited exercise myocardial perfusion imaging. 1.2 MBq/kg TI-201 (range 80-110 MBq) was injected at stress followed by gated SPECT acquisitions 15 minutes and 3 hours later. Cedars-Sinai software package was used to calculate LVEF from early and delayed acquisitions (sGSP-LVEF and rGSP-LVEF, respectively). Each LVEF calculation was performed by two independent observers and the mean value was entered in analysis. The standard deviation (SD) of the difference between sGSP-LVEF and rGSP-LVEF was used to define the limits of reproducibility.

**Results:** sGSP-LVEF = 60.5 ± 8.3 %  
rGSP-LVEF = 58.8 ± 8.0 %  
(sGSP-LVEF + rGSP-LVEF) / 2 = 59.6 ± 7.2 %  
sGSP-LVEF-rGSP-LVEF = 1.7 ± 7.8 %

There was no significant difference between sGSP-LVEF and rGSP-LVEF (paired t-test). However, in 8 cases (27%) a difference of > 10% between sGSP-LVEF and rGSP-LVEF was found.

**Conclusion:** (1) The normal lower limit of TI-GSP LVEF may be set at 43%. (2) Given the reproducibility limits from two independent acquisitions, a TI-GSP LVEF difference of at least 15% may be clinically valid.

## 5.12

### Right ventricular systolic function may commonly be impaired after bypass surgery.

E. Efstratios Moralis<sup>1</sup>, G. Arsos<sup>1</sup>, T. Spyridonidis<sup>2</sup>, N. Karatzas<sup>1</sup>, K. Karakatsanis<sup>1</sup> <sup>1</sup>Hippokraton Hospital, Thessaloniki, Greece, <sup>2</sup>Rio Hospital, Patras, Greece

**Aim:** In patients submitted to coronary artery bypass grafting much attention is placed on left ventricular ejection fraction (LVEF). However, limited data exist on right ventricular ejection fraction (RVEF) changes.

This study investigates RVEF in patients having undergone bypass surgery.

**Method:** Over a 1-year period, among all patients referred for routine myocardial perfusion imaging, and no history of lung disease or significant valve disease, 394 were identified, fulfilling any of the following entry criteria at scan date: (a) Angiographically known coronary artery disease, but no coronary intervention (group CAD), (b) Previous acute myocardial infarction (AMI), but no coronary intervention (group AMI), (c) Coronary artery bypass grafting at least 3 months before imaging, but no previous AMI (group CABG), (d) Previous AMI followed by coronary artery bypass grafting at least 3 months before imaging (group AMI+CABG).

Patients underwent equilibrium radionuclide angiography in the best septal view after completion of TI-201 myocardial scintigraphy. Both LVEF and RVEF were calculated in the standard manner, using a previously validated methodology.

**Results:** These are summarized in table 1 (LVEF and RVEF values are presented as mean (SD), ns=non-significant, \*Mann-Whitney U).

Multivariate analysis showed LVEF to be a predictor of RVEF only in group CABG. In this group, the correlation coefficient between RVEF and LVEF was r=0.38 (p<0.0001). Multivariate analysis showed no predictor of RVEF, in either bypass surgery group, among the following variables: age, sex, time from surgery to scan, haemodynamic variables at stress testing, and imaging result.

**Conclusion:** In patients having been submitted to coronary artery bypass grafting RVEF tends to be reduced. This may be due to surgery itself or to patient selection (significant disease).

**Table 1.**

Groups	n	LVEF (%)	RVEF (%)
CAD	31	57 (12)	46 (6)
CABG	113	56 (11)	43 (6)
	p=ns*	p<0.02*	
AMI	211	52 (14)	46 (8)
AMI+CABG	39	47 (15)	42 (6)
		p=ns*	p<0.002*

## 5.13

### Post-stress stunning in gated SPECT MIBI: comparison between different modalities of stress and the prognostic implication.

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**Introduction:** Post-stress stunning(PSS) is often seen in MPI as regional contractility dysfunction on post-exercise images, which reverses in resting images. This prospective study was undertaken to see if the same type of stunning was observed in pharmacological stress and whether there was any prognostic implication of this coupled with other parameters like lung uptake and TID.

**Materials & Methods:** 210 subjects underwent MPI with 99mTc-SestaMIBI. Of this, 120 were subjected to TMT, 72 underwent Adenosine stress and the remaining 18 with Dobutamine. The criteria for PSS was defined when there was a decrease of more than 10% of EF during post-stress images, associated with or without RWMA.

**Results:** Semiquantitative analysis was performed and segments were classified into normal, ischemic, infarct with ischemia and fixed defects. The presence of lung uptake and TID was also noted. Of the total 210 subjects, 58 subjects showed PSS, out of which 40 were subjects with TMT, 15 with Adenosine and the remaining 3 were with Dobutamine. The distribution of PSS subjects with ischemia, infarct with ischemia and fixed defects for each type of stress is mentioned in Table 1. The change in EF was also noted in all the three types of stress and the maximum range of change was seen on TMT followed by Dobutamine. This was more in subjects who had infarct with ischemia, followed by subjects with fixed defects and subjects with only ischemia. When correlated with the Lung uptake and TID, findings amongst the 58 PSS subjects, 63.79%(37/58) of patients who had infarct with ischemia also had lung uptake and/or TID, 13.79%(08/58) had fixed defects along with Lung uptake and/or TID and finally 5.17%(3/58) had ischemia along with lung uptake and /or TID

**CONCLUSION:** PSS is frequently observed in MPI with SestaMIBI, is more seen in areas which has a mixture of infarct and ischemic segments. It is also more commonly seen in routine exercise and along with Lung uptake and TID, also may have prognostic importance of future cardiac events, which needs to be further validated

**Table 1.** PSS in different types of stress(Table1)

	Ischemic	Infarct with ischemia	Fixed defects	Total
TMT	2(5%)	29(72%)	9(22%)	40
Adenosine	2(13.35%)	9(60%)	4(26.6%)	15
Dobutamine	0	02(66.6%)	01(33.3%)	03

## 5.14

### Is chronic ST segment elevation a marker of myocardial non viability in patients with Q wave antero-septal MI? Correlation with myocardial perfusion SPECT.

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Persistence of ST segment elevation for more than 2-4 weeks in pts with acute antero-septal transmural myocardial infarction (ASMI) is considered to be a specific marker of left ventricular aneurysm.

**Aim:** We attempted to assess the face value of this statement by correlating the findings of 99mTc Sestamibi Myocardial perfusion SPECT (MPSPECT) & resting 12 lead ECG. **Method:** 240 ASMI patients (192 : 48 Male : Female pts, age range 36-71 yrs, Mean 51 ± 8 yrs) referred for risk stratification between Jan 02-Jan 04 were retrospectively analyzed. Demographic details & LV systolic function parameters were same for all these pts. The mean LV EF at rest was 40 ± 6 %.

Inclusion criteria were patients with Q Wave ASMI > 1 month old & ECG at rest showing sinus rhythm, QRS < 120 ms, Q waves in 2 contiguous leads from V1 to V3 & with or without ST segment elevation of > 1.5 mm. Pts with atrial arrhythmias & bundle branch block were excluded.

Pts underwent same day rest stress gated MPSPECT on a dual head variable angle gamma camera. Pts performed either conventional treadmill stress or taken up for pharmacological stress. LAD territory myocardial segments were evaluated for ischaemia & viable myocardium. Images were visually interpreted & using a 16-segment myocardial model quantification was also performed.

Presence of reversible perfusion defects, > 40% uptake of MIBI at rest and myocardial systolic wall thickening in gated images (count increase by at least 10% during systole) were considered as markers of viability.

**Results:** Patients were categorized into two groups. ST elevation positive i.e. patients with rest ST elevation > 1.5 mm (137 pts 57%) & ST elevation negative (103 pts 37%) by the rest ECG criteria. In ST positive group, 47/137 pts (34%) showed viability (mean viable segments 5 ± 0.8) while 90/137 (66%) did not show viability (mean viable segments 2 ± 0.9). In ST negative group, 56/103 pts (54%) showed viability (mean viable segments 6 ± 0.7) while 47/103 (46%) did not show viability (mean viable segments 3 ± 0.4).

Based on results of MPSPECT, from ST positive group 28/47 pts (60%) underwent revascularisation & 23/28 pts (82%) showed an improvement in LV ejection fraction at least by 5%.

**Conclusion:** Our study shows MPSPECT is an effective way of assessing viability even in presence of chronic ST elevation in Q wave ASMI patients. The mere persistence of chronic ST elevation in patients with ASMI does not exclude viability & should not preclude the cardiologist from assessing the patients for revascularisation potential.

## 5.15

### FDG PET semiquantitative analysis in patients with severe ischemic left ventricular dysfunction: prediction of functional recovery after coronary revascularization.

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Functional recovery after coronary revascularization might be predicted by quantitative analysis of fluorine F18 fluorodeoxyglucose (FDG) positron emission tomography (PET). The objective of this study was to demonstrate the usefulness of PET FDG visual semiquantitative analysis predicting functional recovery after revascularization in severe ischemic left ventricular dysfunction.

**Methods:** All patients had previous myocardial infarction (MI) (>6 months) and left ventricular systolic dysfunction (LVEF<40%). FDG PET, transthoracic echocardiography and coronary angiography were provided for all pts. All subjects underwent euglycemic hyperinsulinemic clamp before the injection of FDG. The results of PET scans and echocardiograms were analysed semiquantitatively (dividing the left ventricle in 17 segments; score from 0=normal to 4=absence of detectable tracer uptake in one segment for PET and score from 1=normal to 4=dyskinetic segments) by two operators. The 1-year follow-up was clinical and echocardiographic in the available pts. The ventricular segment (echo score 2-3) was defined viable when: a) PET FDG segment uptake proved to be in the range from normal to moderately/severely reduction (score 0-3) and b) improved by 1 grade or more in the echo score at 1-year follow-up after coronary revascularization.

**Results:** Thirty-three consecutive patients (25 males, mean age 63 ys) were studied. The mean LVEF was 30.2±6.9%; 15 suffered an anterior MI, 13 non-q MI and 5 inferior MI. At coronary angiography 1/33 did not reveal any critical stenosis, 15 (45.4%) single-vessel disease, 7 (21.2%) two-vessel and 10 (30.3%) three-vessel disease. Nineteen (57.5%) pts were treated with coronary revascularization (3 with PTCA and 16 with CABG); 4 died a cardiac death. In the 15 pts alive, 173 dysfunctioning segments were observed, 145 were revascularized and 74 (51%) improved. At follow-up LVEF increased from 31±6.9% to 37.3±12.4% (p=0.04) and wall motion score index reduced from 1.9±0.3 to 1.5±0.4 (p=0.04). The prediction of functional recovery after coronary revascularization of the FDG PET was calculated according to different degree of reduction of FDG uptake [normal/moderately reduction (score 0-2) or normal/severely reduction (score 0-3)]. Sensitivity, specificity, positive predictive value and negative predictive value of FDG PET were calculated according to score 0-2 or score 0-3 (82%, 58%, 67%, 76% and 93%, 54%, 69%, 88% respectively).

**Conclusions:** The semiquantitative analysis of FDG PET might identify viability in severe ischemic left ventricular dysfunction.

## 5.16

### Prognostic value of rest-redistribution 201-thallium imaging in patients with chronic coronary artery disease and left ventricular dysfunction.

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Scintigraphic 201-Thallium (201TI) stress imaging has been proven to provide relevant prognostic information in patients with ischemic left ventricular dysfunction. In contrast, studies using rest-redistribution 201TI imaging reported discordant results regarding the prediction of major adverse cardiac events.

**Aim.** To evaluate the prognostic role of rest-redistribution 201TI SPECT imaging in patients with chronic coronary artery disease and impaired left ventricular function.

**Methods.** One-hundred twenty-six patients with chronic coronary artery disease and mean left ventricular ejection fraction 39±11% were followed-up for 30±17 months after a rest-redistribution 201TI imaging SPECT. Cardiac death and non-fatal myocardial infarction were considered as major cardiac events

**Results.** A total of 20 events (11 deaths and 9 myocardial infarctions) were recorded during follow-up. By Cox multivariate analysis the number of severe irreversible SPECT defects was the only variable associated with outcome (chi-square=5.06; p=0.024 for death + myocardial infarction; and chi-square=10.6, p<0.001 for death alone). By Kaplan-Meier analysis mortality was significantly different among patient with ≥3 (2%) severe defects as compared to patients with >3 severe defects (17%; log rank 8.68; p=0.0032). Death or myocardial infarction occurred in 62% of patients with >3 severe defects compared to 13% of patients with ≥3 severe defects (chi-square=18.04; p<0.0001). Event-free survival was longer among patients with ≥3 severe defects than among patients with >3 severe defects (58±2 vs 16±3 months; p<0.0001).

**Conclusions.** The number of severe irreversible defects using rest-redistribution 201TI SPECT is a powerful predictor of major cardiac events among patients with moderate ischemic left ventricular dysfunction.

## 5.17

### Incremental diagnostic value of automatic quantitative analysis of myocardial SPECT in women with and without coronary artery disease.

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**Aim:** Previous studies suggested that diagnostic non-invasive tests for assessing coronary artery disease may be less accurate in women than in men. Whether automatic quantitative evaluation of myocardial GSPECT can aid in guide the decision making process is still debated.

**Materials and methods:** To this purpose we studied 64 consecutive women (mean age  $64 \pm 9$  ys) who underwent diagnostic exercise 99mTc-Tetrofosmin GSPECT and catheterization within 2 months. Significant coronary artery disease ( $> 50\%$  stenosis, CAD) was present in 29 patients while 35 had normal coronary angiograms. Nine patients had single, 12 double and 8 triple CAD. Twenty-one patients had previous myocardial infarction while 42 presented anginal symptoms. Myocardial perfusion analysis was performed by visual interpretation (perfusion defect reversibility) and using both semiquantitative visual analysis and QPS/QGS software (E.Soft, Cedar Sinai) providing perfusion scores and indexes of LV function in a 20-segment model. **Results:** Univariate predictors of coronary artery disease included: age; diabetes; angina; previous myocardial infarction; previous PTCA; stress induced angina and significant downloading of ST segment; perfusion SPECT visual interpretation and both qualitative and quantitative summed stress and summed difference scores; summed motion and summed thickening difference scores; stress-induced end-diastolic volume and EF impairment. Multivariate logistic analysis of the most predictive and not correlated variables revealed both quantitative summed difference score and EF impairment after exercise as the most important predictors of significant coronary artery disease ( $p < 0.001$ ).

Perfusion defect reversibility at visual analysis correctly predicted coronary artery disease in 26/27 (96%) pts while excluded it in 13/35 (37%), resulting in a global accuracy of 0.61. According to ROC curves analysis, the optimal cut-off to identify coronary artery disease was 1 for qualitative summed difference score and 2 for quantitative summed difference score. Using these cut-offs, global diagnostic accuracies were 0.68 and 0.95, respectively, ( $p < 0.001$ ). Moreover, ROC analysis showed that a reduction in EF during exercise  $> 2\%$  was the optimal cut-off to identify women with coronary artery disease (sensitivity: 0.86; specificity: 0.80; accuracy: 0.89).

**Conclusion:** Our data suggest that automatic quantitative analysis of myocardial GSPECT is superior to qualitative assessment alone providing indexes of both perfusion and function highly predictive of coronary artery disease in women.

## 5.18

### Extension and severity of rest perfusion abnormalities assessed by gated SPECT influence clinical efficacy of resynchronisation therapy.

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The role of rest perfusion abnormalities in patients with heart failure due to idiopathic or ischaemic cardiomyopathy undergoing cardiac resynchronisation therapy (CRT) is controversial. To this aim, 14 patients with ischaemic (CAD) and 22 patients with idiopathic (DCM) cardiomyopathies were studied by echocardiography and 99mTc tetrofosmin gated SPECT at rest and within two months after CRT under the same medical treatment. Before CRT, all patients had a QRS interval over 120 msec and showed similar degrees of LV dyssynchrony. In both groups, responders were defined as having an increase  $> 5$  EF units at gated SPECT. Overall, 54% of DCM and 35% of CAD patients improved after CRT. The two groups did not show significant differences in end diastolic volume index ( $156 \pm 5$  vs  $173 \pm 52$  ml), end systolic volume index ( $122 \pm 18$  vs  $140 \pm 18$  ml), ejection fraction ( $24 \pm 7$  vs  $20 \pm 6\%$ ), end diastolic diameter ( $67 \pm 8$  vs  $70 \pm 7$  mm), degree of mitral regurgitation ( $2.2 \pm 7$  vs  $2.5 \pm 8$ ), left ventricular extension of abnormal wall motion ( $59 \pm 19\%$  vs  $66 \pm 18\%$ ) and summed motion score ( $46 \pm 11$  vs  $53 \pm 11$ ) ( $p = ns$  for all values). However, DCM patients showed a less impaired perfusion than CAD patients. In fact, left ventricular extension of perfusion defect ( $30 \pm 16\%$  vs  $12 \pm 7\%$ ,  $p < .001$ ) and summed rest score ( $25 \pm 13$  vs  $8 \pm 4$ ,  $p < .0001$ ) were significantly higher in CAD. In conclusion, gated SPECT characterisation could contribute to the selection of those patients who benefit more from resynchronisation. In fact, at similar degrees of volume overload, regional wall motion abnormalities and mitral regurgitation, the extension of perfusion abnormalities may condition the percentage of responders.

## 5.19

### Volume overload modulates improvement of myocardial perfusion induced by cardiac resynchronisation therapy.

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Cardiac resynchronisation therapy (CRT) may induce significant changes in perfusion and wall motion. However, the link between these variables in patients with heart failure has not been investigated. To this purpose, 36 patients with idiopathic (22) or ischemic (14) cardiomyopathy (mean age  $70 \pm 8$  yrs, 25 male), a QRS interval over 120 msec and interventricular dyssynchrony were studied by echocardiography and gated SPECT before and within 2 months after CRT under the same medical treatment. Gated SPECT provided perfusion, volumes and ejection fraction (EF). Patients were classified into 2 groups according to an increase of at least 5 EF units. In 17 patients (Group A) EF increased from  $24 \pm 8$  to  $36 \pm 11\%$ , while it was unchanged in 19 patients of Group B ( $20 \pm 7$  to  $19 \pm 7$ ). Similarly, Gated SPECT summed thickening score was reduced by CRT in Group A ( $34 \pm 6$  to  $25 \pm 8$ ,  $p < .01$ ) and was unchanged in Group B. CRT increased regional myocardial perfusion at rest in both groups (Group A defect extension 17 to 12%, Group B 21 to 18% of the left ventricle,  $p < .01$ ; Group A summed rest score 12 to 8, Group B 17 to 14,  $p < .01$ ). However, when compared to Group B, patients of Group A showed before CRT a smaller end diastolic volume index ( $126$  vs  $195$  ml,  $p < .0001$ ), end systolic volume index ( $97$  vs  $157$  ml,  $p < .0001$ ) and echocardiographic end diastolic diameter ( $63$  vs  $72$  mm,  $p < .001$ ). Beyond volumes, NYHA class resulted the best predictor factor. Thus, CRT induced a significant "reperfusion" both in ischemic and idiopathic cardiomyopathies. This reperfusion did not improve left ventricular function in patients with more severe volume overload. Simultaneous evaluation of perfusion and volume may identify CRT responders.



CRT example

## 5.20

### Hibernating myocardium in ischemic left ventricular dysfunction: relationship to the clinical presentation.

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Patients with ischemic left ventricular dysfunction might or might not be symptomatic for angina. The objective of this study was to correlate angina with the presence of hibernating myocardium revealed with Tc-99m tetrofosmin single photon computed emission tomography (SPECT) and fluorine F18 fluorodeoxyglucose (FDG) positron emission tomography (PET).

**Methods:** All patients had previous myocardial infarction (MI) ( $> 6$  months) and left ventricular systolic dysfunction (LVEF 40%). Adenosine/rest Tc-99m tetrofosmin SPECT (with GATED analysis), PET FDG and coronary angiography were provided. All subjects underwent euglycemic hyperinsulinemic clamp before the injection of FDG. The results of SPECT and PET scans were analysed semiquantitatively (dividing the left ventricle in 17 segments; score from 0=normal to 4=absence of detectable tracer uptake in one segment) by two different operators. The scintigraphic summed stress score (SSS), summed rest score (SRS), summed difference score (SDS) and summed PET score (SPS) were calculated. The perfusion/metabolism mismatch defined viable myocardial tissue in each ventricular segment.

**Results:** Sixty-four consecutive patients (52 males, mean age  $64.7 \pm 8.8$  ys) were studied. The mean left ventricular ejection fraction was  $30.5 \pm 7.7\%$ ; 35 (54.7%) suffered an anterior MI, 13 (20.3%) non-q MI and 16 inferior MI. At coronary angiography 2/41 pts did not reveal any critical coronary stenosis, 17 (26.5%) a single-vessel disease, 22 (34.3%) a two-vessel and 25 a three-vessel disease. Angina was observed in 9 (14%) (group A) while dyspnea in 55 (86%) (group B). The two groups did not differ in age ( $p = 0.1$ ), LVEF ( $31.2 \pm 7.7$  vs  $30.4 \pm 7.8$ ,  $p = 0.8$ ), SRS ( $21 \pm 11.6$  vs  $23.4 \pm 10.7$ ,  $p = 0.5$ ), SSS ( $24.2 \pm 10.7$  vs  $24.9 \pm 11$ ,  $p = 0.8$ ) and SDS ( $3.2 \pm 4.3$  vs  $3 \pm 3.9$ ,  $p = 0.9$ ). Six patients in group A and 14 in group B were diabetics ( $p = 0.9$ ). Ischemic left ventricular involvement seemed to be smaller in patients admitted for angina (SPS  $12.6 \pm 9.5$  vs  $20 \pm 10.6$ ,  $p = 0.05$ ). According to the perfusion/metabolism mismatch, non-viable segments were verified most in pts with dyspnea than in angina group ( $5.5 \pm 2.5$  vs  $3.2 \pm 2.3$ ,  $p = 0.01$ ).

**Conclusions:** Inducible ischemia at myocardial scintigraphy was not different in pts suffering ischemic left ventricular dysfunction according to the presence of angina. The extension of non-viable myocardium tissue seemed to be larger in patients admitted for dyspnea.

## 5.21

### Cardiotoxicity after anthracycline chemotherapy in breast carcinoma: effects on left ventricular ejection fraction, troponin I and neurohormonal assessment.

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The incidence of congestive heart failure (CHF) after anthracycline chemotherapy in patients affected by breast carcinoma varied from 2% to 26% according to the dosage of the drug. The incidence of asymptomatic left ventricular dysfunction is certainly higher and the cytotoxic damage could be revealed early. The aims of this study were: a) to evaluate the early modification of left ventricular ejection fraction (LVEF) obtained with multiple gated radionuclide ventriculography after the first 6 cycles of chemotherapy and b) to analyse the effects of chemotherapy on troponin I and neurohormonal assessment.

**Methods.** Patients with early breast cancer that underwent surgical treatment followed by chemotherapy were enrolled. The chemotherapy consisted in a single bolus infusion of epirubicin 90 mg/mq, cyclophosphamide 600 mg/mq, fluorouracil 600 mg/mq repeated every three weeks for 6 cycles. The presence of coronary artery disease, valvular disease, left ventricular dysfunction (LVEF  $\pm$  nth after the last chemotherapy cycle. LVEF was performed by radionuclide ventriculography using multigated ECG triggered sampling with at least 32 frames each RR interval.

**Results.** 30 pts (29 females, age  $60 \pm 12.4$  ys) were included. At follow-up none developed overt CHF. A significant reduction LVEF was demonstrated at radionuclide ventriculography ( $62 \pm 5.8$  % vs  $59 \pm 7.3$  %,  $p=0.01$ ). The BNP plasma level increased (from  $36.7 \pm 49.1$  pg/ml to  $76 \pm 114.4$  pg/ml,  $p=0.01$ ) so as the level of troponin I (from  $0.01 \pm 0.01$  ng/ml to  $0.07 \pm 0.04$  ng/ml,  $p=0.0001$ ). No significant differences were obtained in the dosage of E1 (from  $0.6 \pm 1.41$  fmol/ml to  $0.27 \pm 0.3$  fmol/ml,  $p=0.1$ ) or rest plasma aldosterone (from  $90.9 \pm 42.5$  pg/ml to  $79 \pm 35.9$  pg/ml,  $p=0.2$ ).

**Conclusions.** Radionuclide ventriculography revealed early reduction of LVEF after anthracycline chemotherapy. BNP and troponin I might be considered promising tests for early detection of induced cardiotoxicity.

## 5.22

### Role of myocardial perfusion SPET in the new era of active stent.

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**Introduction.** Sirolimus-eluting stent implantation (SESI) is a novel effective approach in treating patients with significant and complex coronary disease. In fact, Sirolimus, a potent immunosuppressive agent, demonstrated itself to be able to inhibit the neointimal hyperplasia.

**Aim.** Since the physio-pathologic mechanism which occurs in the arterial wall, the hemodynamic repercussions and the long term efficacy are still under investigation, we needed to verify the accuracy of myocardial perfusion SPET in re-evaluating patients treated with SESI.

**Methods.** Forty-three (11F; 32M) consecutive patients (mean age: 56y) underwent stress/rest SPET, 5 months after SESI in a single vessel (4RCA; 38LAD; 1CX). In 20 pts SESI allowed complete revascularization, while in 8 patients a further bare-metal stent was implanted in another territory during the same session. In the remaining 15 pts a partial revascularization was performed.

Q or notQ wave infarction in target vessels was present in 20 pts. In 22/43 patients angiography was performed in addition to the clinical follow-up within 6 months of SESI. Stent restenosis was defined as a greater than 70% luminal diameter stenosis at the stented site or at proximal/distal adjacent site. A SPET visual analysis, using a 20-segments scoring model, was considered indicative of restenosis when at least 2 contiguous reversible perfusion defects in the stented territory were present.

**Results.** In detecting restenosis, coronary angiography and SPET were concordant in 20 SESI territories (3TP, 17TN), while in 2 territories were discordant (SPET positive for ischemia with a normal angiography). These data lead to the following results: sensitivity=100%, specificity=89%, accuracy=91%, PPV=60%, NPV=100%. If we include in the SPET vs angiography analysis the non-SESI vessels too, in order to evaluate the progression of disease or previous incomplete revascularization, SPET showed stress-induced perfusion defects in 18/66 (14TP; 4FP) vascular territories and normal districts in 48/66 (46TN; 2FN). So, the overall results on 66 vascular territories showed sensitivity and specificity of 88% and 92% respectively. The accuracy, PPV and NPV were 91%, 78% and 96%.

**Conclusions.** These results indicate that SPET visual analysis has high accuracy in detecting SESI restenosis, and they are in good agreement with literature for the evaluation of restenosis in bare-metal stenting. So, the test can be a useful non-invasive diagnostic procedure in patients potentially more resistant to the action of Sirolimus.

## 5.23

**Assessment of inotropic reserve during repetitive exercise in patients with primary dilated cardiomyopathy by radionuclide ambulatory monitoring of left ventricular function (II C-VEST).** E. Casorelli<sup>1</sup>, F. Del Dottore<sup>2</sup>, G. Gentili<sup>3</sup>, M. Agostini<sup>4</sup>, P.L. Pierluigi Pieri.<sup>5</sup> <sup>1</sup>"M. Bufalini" Hospital, Cardiovascular Medicine, Cesena, Italy, <sup>2</sup>"M. Bufalini" Hospital, Health Physics Dept, Cesena, Italy, <sup>3</sup>M. Bufalini Hospital, Nuclear Cardiology, Cesena, Italy, <sup>4</sup>"M. Bufalini", Nuclear Medicine, Cesena, Italy, <sup>5</sup>M. Bufalini Hospital, Nuclear Cardiology, Cesena, Italy

**Aim:** To assess if the preservation or deterioration of the inotropic reserve (IR) during repeated Exercises (Ex) could characterize a different stage in the evolution of patients with primary dilated cardiomyopathy (DCM).

**METHODS:** Fifteen patients with primary DCM (9 male; age  $55.4$  (42-79yrs); LVEF  $33.5\%$  (17-45%) and 3 normal subjects age  $54.3$  (23-72yrs); LVEF  $67.3\%$  (60-71%)) underwent radionuclide ambulatory monitoring of LV function (II C-VEST-Capintec) during repeated Ex. LVEF, EDV, ESV, Stroke Volume (SV), CO, Peak Filling Rate (PFR) and HR were measured at rest and during each Ex. including walking on the floor, climbing stairs and bicycle Ex. in different combinations and levels depending upon the functional capacity of each patient.

**RESULTS:** In the normal subjects, during Ex. tests, HR, LVEF, EDV, CO and SV significantly increased from rest to peak, while ESV significantly decreased from rest to peak. Three groups of patients were identified: In 5 pts (Group I) LVEF, EDV, SV and CO consistently increased during all Ex. suggesting a preserved IR. In 6 pts (Group II) LVEF, EDV, SV and CO increased only during the first Ex. and did not increase during the subsequent exercises consistent with partial deterioration of IR. Furthermore they showed a transient reduction of LVEF after stress below the basal value. In 4 pts (Group III) LVEF, SV and CO decreased during all Ex. consistent with permanent exhaustion of IR. Pts of group III were older (age  $66.2 \pm 9.1$  vs Group II  $54.6 \pm 6.8$ ,  $p=0.49$ ); had a longer time interval between diagnosis of DCM and the time of the study ( $10.5$  yrs  $\pm 11$  vs Group I  $2.8 \pm 1.7$ ,  $p=NS$ , t-value 1.5; vs Group II mean value  $2.3 \pm 1.9$  p NS, t-value 1.8) and had a lower rest LVEF ( $29.0\% \pm 9.5$  vs Group II:  $40.2\% \pm 5.5$ ,  $p=0.44$ ; vs Group I  $37.8\% \pm 11.03$ ,  $p=NS$ , t-value 1.3).

In the only patient who performed the first study without any therapy because of the recent diagnosis, showing a partial deterioration of the inotropic reserve (Group II) a second VEST study performed after one year of therapy with beta-block, and ACE-I showed an improvement of inotropic reserve during repetitive Ex., as in pts of Group I.

**CONCLUSION:** This study shows the potential usefulness of radionuclide ambulatory monitoring of LV function by VEST in assessing the inotropic reserve (IR) during repeated Ex. in pts with primary DCM. A partial or total exhaustion of IR could characterize more severe stages in the evolution of primary DCM. This method could be used for assessing the effects of therapeutic interventions aimed to minimize the progression of left ventricular dysfunction.

## 5.24

### Prognostic value of sestamibi gated SPECT after PCI.

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**Background.** Symptoms and ECG stress testing give many equivocal results after PCI. Therefore there is the need for catheterization to evaluate short and long-term results. Stress imaging is considered an alternative method to catheterization. Aim of the study was to assess prognostic implications of normal Single Photon Emission Computed Tomography (SPECT) in patients with equivocal exercise testing after PTCA. **Methods:** 128 patients were evaluated. All patients had a telephone interview over a period of observation of 18 months after SPECT. Prognostic accuracy was evaluated considering hard and soft events. Prognostic value was determined using stepwise Cox proportional hazards model and Kaplan-Meier survival analysis. **Results:** 29 patients experienced soft events: 15/98 (15.3%) associated with normal (N) and 14/30 (46.6%) with abnormal (A) Single Photon Emission Tomography perfusion pattern in the territory of the dilated vessel ( $c^2 = 11.164$ ,  $p < .0001$ ). Hospitalization for recurrent angina was required in 16 patients (6/30 with A and 10/98 with N SPECT;  $c^2 = 1.219$ ,  $p = N.S.$ ) and 13 patients underwent myocardial revascularization (8/30 with A and 5/98 with N SPECT;  $c^2 = 9.462$ ,  $p < .005$ ). 11/15 (73%) patients who experienced soft events in the presence of N SPECT in the territory of the dilated vessels had evidence of reversible perfusion defects in remote areas. Event free curves were significantly different ( $c^2 = 12.96$ ,  $p < .002$ ) in group with N and A SPECT perfusion pattern in the territory of the revascularized vessel. Only the presence of reversible defects at SPECT in the territory of the dilated vessel showed significant independent prognostic value on multivariate analysis ( $b = 1.549$ ;  $p = .0027$ ). **Conclusions:** SPECT has a high prognostic value in patients with equivocal stress testing after PTCA.

## 5.25

**Role of gated-SPECT imaging for risk stratifications over score charts in predicting silent myocardial ischaemia in hypertensive patients.**

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**Objectives:** It is well known about the lower specificity of stress test to show myocardial ischemia in hypertensive population with ECG evidence of left ventricular hypertrophy. In this study we tried to estimate the additive value of stress/rest gated-SPECT imaging in predicting the prevalence of silent myocardial ischemia (SMI) in asymptomatic hypertensive patients (pts) at moderate-to-increased risk and without known coronary artery disease (CAD).

**Methods:** The study group consisted of 316 (217) pts (140 male, 176 female, mean age  $58 \pm 9$  years) with uncomplicated essential hypertension. Mean duration of hypertension was  $6 \pm 4$  years. After physical and laboratory examination, the ten years absolute risk was estimated using Italian Ministry of Health SCORE risk chart based on the European standard charts. All pts had evidence of left ventricular hypertrophy at 12-leads surface EKG. SMI was detected by stress/rest Tc-99m tetrofosmin gated-SPECT scintigraphy. To perform gated-SPECT study we adopted a dual-day stress/rest protocol. Both post-exercise and resting images were gated and acquired 20-30 minutes after injection of technetium 99m-tetrofosmin at peak of exercise using a dual-head camera. Perfusion quantitation (SSS, SRS, SDS), left ventricular volumes (EDV, ESV) and global ejection fraction (LVEF) were automatically calculated with the use of Autoquant® software package. All patients with definite amount of SMI, that is SSS  $\geq 8$  at gated-SPECT imaging underwent coronary angiography.

**Results:** According to SCORE charts risk stratification, 78 of the cases (25%) were in high, 238 (75%) in moderate risk groups.

SMI was detected in 82 pts (26%), 38 of high and 44 of moderate groups and of whom 75 (91%) had angiographically confirmed CAD. The remaining 7 pts had normal coronary arteries. The majority of pts showed one-vessel disease (64, 78%), 15 (18%) pts revealed double-vessel disease and the remaining 3 pts (4%) triple-vessel disease. SDS score in the ischemic group resulted  $9 \pm 2$ ,  $p < 0.0001$ , with SSS of  $10 \pm 2$ ,  $p < 0.0001$ . 12 pts (14%) demonstrated post-stress left ventricular dysfunction with lowering of LVEF vs resting values. All these pts had multi-vessel disease.

Thus the specificity and positive predictive value were 97% and 91% respectively.

**Conclusion:** In addition to International SCORE charts, a risk stratification based on stress gated-SPECT imaging is a sensitive method to detect SMI in selected hypertensive individuals at moderate-to-high risk. It also has a high positive predictivity to confirm CAD in SMI patients.

## 5.26

**Hemodynamic effects of dual-chamber pacing versus ventricular pacing during walk test in patients with heart block and depressed or normal left ventricular function.**

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**Aim:** Dual-chamber rate-modulated pacing provides hemodynamic benefits over ventricular pacing at rest, but it is unclear if this effect also occurs during physical exercise. This study assessed the hemodynamic response to walk test during dual-chamber pacing and ventricular pacing in patients with depressed or normal left ventricular (LV) function.

**Methods:** Nineteen patients with dual-chamber rate-modulated pacemaker implanted for complete nodal atrioventricular block were studied. Patients were divided into 2 groups: 10 patients with ejection fraction 50% (group A) and 9 with ejection fraction  $\geq 50\%$  (group B). LV function was monitored by a radionuclide ambulatory system. Baseline measurements were made with patients in seated position over a period of 10 min; thereafter all of them performed 2 walk tests. Each walk test (6 min at the optimal speed) was randomly performed during either ventricular-only backup pacing (70 beats/min; fixed rate) or dual-chamber rate-modulated pacing according to a randomized crossover design. The change of pacing mode was performed after 10 min recovery, when blood pressure, symptoms and cardiac volumes recovered. Each pacing mode was maintained for at least 5 min under the 2 resting conditions before the respective walk tests.

**Results:** All patients were able to complete the two walk tests without breaks in continuity. Patients of group A complained of mild dyspnea and fatigue at the end of the two walk tests without difference in symptoms between the two tests. Conversely, patients of group B did not develop any symptoms during the two tests. In group A, no difference in all parameters between the two pacing modes was found at rest, whereas at peak of walk test end-systolic volume was lower during ventricular pacing compared to dual-chamber pacing ( $P < .005$ ). Consequently, ejection fraction and stroke volume showed higher increase at peak of walk test during ventricular pacing compared to dual-chamber pacing (both  $P < .01$ ). In group B, the change from dual-chamber pacing to ventricular pacing induced a decrease of cardiac output at rest and a lesser increase at peak of walk test (both  $P < .05$ ).

**Conclusion:** In patients with heart block and depressed LV function ventricular pacing at fixed rate improves cardiac contractility and does not affect cardiac output compared to dual-chamber rate-modulated pacing during moderate physical activity. The benefit of lower heart rate on LV function and the adverse effects of ventricular desynchronization, mitigating the benefit of atrioventricular synchrony, may explain these findings.

## 5.27

**Intra ed interobserved reproducibility of EF by gated-SPECT.**

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**Background:** the diagnostic accuracy of quantitative gated-SPECT (QGS) and the potential limitations for estimation of left ventricular ejection fraction (LVEF) have been extensively evaluated. However, few studies have focused on test reproducibility. High reproducibility is mandatory in follow-up studies especially in the evaluation of LV performance in pts under aggressive medical treatment for heart failure. Aim: this study was conducted to assess QGS variability for LVEF determination between studies processed by three independent readers (technologist (TCH), senior attending physician (AP) and fellow (F)) and between two sequential Sestamibi-gated SPECT. Methods: acquisitions were performed at 1 and 2 h after a single injection of 1100 MBq of Tc-99m-Sestamibi at rest. No attenuation correction was adopted. 29 pts with congestive heart failure were examined. Results: no significant differences were observed between the three readers in both acquisitions by analysis of variance. However significant differences were observed by all three readers between acquisition 1 and 2 (see table). The correlation between EF1 and EF2 of pooled data was ( $y = 1.0422x - 3.7536$ ,  $R^2 = 0.8193$ ,  $SE = 3.65$ ). The mean serial variability of EF of pooled data was  $-2.2 \pm 4.2$ . Conclusion: QGS is sufficiently robust to minimize reporting differences between readers, independently of their experience. The EF measured after a time interval of 2 hours from injection seems to be significantly lower than that obtained after 1 hour. It is not clear if the differences are related to technical or physiopathologic changes (EF may be altered by pre-load, after-load, contraction rate, autonomic nerves, hormones and drug Kinetics). In follow-up studies the time delay between tracer injection and acquisition should be always the same.

**EF differences between acquisition 1 & 2**

	EF1(%)	EF2(%)	
TCH	$36.7 \pm 8.9$	$34.6 \pm 10$	$P < .03$
AP	$37 \pm 8.9$	$34.6 \pm 10.2$	$P < .01$
F	$37.4 \pm 8.1$	$35.1 \pm 9.8$	$P < .005$

TCH = technologist AP = expert attending physician F = fellow

## 5.28

**The utility of SPECT/CT for the detection of cardiac sarcoidosis on Gallium-67 scintigraphy.**

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For patients with sarcoidosis, the early detection of myocardial involvement is very important. Gallium-67(Ga) scintigraphy is commonly used for the detection of sarcoidosis, including the evaluation of myocardium. However, Ga planar imaging has some limitations especially in spacial resolution. Single photon emission computed tomography (SPECT) should overcome some of these limitations, but precise localization of abnormalities is still difficult. Recently SPECT/CT became available, and attenuation correction (AC) and fusion image techniques have been developed. These advances have a possibility to detect myocardial sarcoidosis more precisely.

**Aim:** To explore the utility of SPECT/CT using attenuation correction and image fusion techniques for the detection of abnormal Ga uptake in myocardium.

**Method:**

Between January 2003 and August 2004, we enrolled 7 patients before steroid therapy into the study. All patients are diagnosed cardiac sarcoidosis clinically or pathologically. Ga scintigraphy was performed at 72 hours after the injection of either 74 MBq of Ga-67 citrate with a dual-head gamma camera equipped with a low-power x-ray system (Millennium VG & Hawkeye; General Electric Medical Systems, Milwaukee, WI). We evaluated myocardial Ga uptake on planar images, SPECT and SPECT/CT (using AC and fusion image techniques). Images were interpreted as positive if myocardial uptake was higher than mediastinal uptake.

**Result:** The detection rate of myocardial abnormal uptake by planar images, SPECT and SPECT/CT was 28.6%(2/7), 71.4%(5/7) and 100%(7/7), respectively. The detection rate of SPECT is apparently higher than planar images, but lower than SPECT/CT. CT-based AC makes lung uptake lower and myocardial uptake higher. Moreover, CT fusion technique makes it clear whether the abnormal uptake locates in the myocardium or not.

**Conclusion:** Our results showed higher detection rate of SPECT/CT than planar images or SPECT. For the detection of cardiac sarcoidosis using Ga scintigraphy, SPECT is at least required. SPECT/CT is thought to be more desirable.



## 5.29

### Prognostic value of stress myocardial perfusion imaging in patients with mildly or moderately impaired left ventricular function who had no chest pain and were suspected for coronary artery disease.

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Left ventricular ejection fraction (LVEF) is generally useful for predicting cardiac events in patients with heart disease. However, it may not be suitable for predicting prognosis in patients with mildly or moderately impaired LV function.

**Aim:** We investigated prognostic value of myocardial perfusion imaging (MPI) in patients with mildly or moderately impaired LV function who had no chest pain but were suspected for coronary artery disease (CAD).

**Methods:** Consecutive patients (n=70, mean age=68, diabetes=27, non diabetes=39) who had no chest pain but mildly or moderately impaired LV function (mean LVEF=51%) and were suspected for CAD were followed-up for 2.4 years after stress MPI. Primary endpoints were defined as cardiac death, hospitalization for congestive heart failure (CHF), acute coronary syndromes (ACS) and revascularization. Images were scored using a 20-segment model and a 0-4 scale, and then summed stress, rest and difference scores (SSS, SRS, SDS) were calculated.

**Results:** During follow-up, cardiac death in 3 patients, hospitalization for CHF in 8 patients, ACS in 1 patient and revascularization in 7 patients occurred. Multivariate Cox regression analysis demonstrated that SDS=7 was the best predictor of cardiac events especially in diabetic patients as shown in Table. LVEF was not a predictor of cardiac events.

**Conclusion:** Stress MPI is useful for predicting cardiac events in patients with no chest pain if they showed mildly or moderately impaired LV function, especially in diabetic patients.

#### Multivariate Cox regression analysis

Patients	Predictors	Hazard ratio	95%CI	P value
Overall	SDS $\geq$ 7	3.3	1.2-9.2	0.019
Overall	SSS $\geq$ 7	2.3	0.89-6.0	0.084
Overall	SRS $\geq$ 7	1.7	0.61-4.7	0.31
Overall	EF < 50%	1.2	0.45-3.1	0.75
Diabetes	SDS $\geq$ 7	8.3	1.6-42.0	0.011

## 5.30

### Mismatch area within non-infarcted myocardium using 123I-BMIPP/Tl-201 images might have improved left ventricular functional outcome after acute myocardial infarction.

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**Background:** Recent studies suggested that perfusion-metabolic mismatch area with regional uptake of 123I-BMIPP (BMIPP) less than that of Tl-201 (Tl) had been a predictor for functional improvement after restoration of flow in patients with myocardial infarction. But, the clinical implication of mismatch area within non-infarcted myocardium has not been established. The current study has paid attention to mismatch area within non-infarcted myocardium using BMIPP/Tl images.

**Objective:** The aim of this study was to assess the left ventricular functional outcome of the amount of perfusion-metabolic mismatch within non-infarcted myocardium in optimal revascularized patients with acute myocardial infarction by means of BMIPP/Tl images.

**Methods:** In 131 patients (87 male, 74  $\pm$  8 years) with acute myocardial infarction, dual resting SPECT with BMIPP and Tl at the subacute phase after optimal catheter revascularization had been worked out. Moreover, two-dimensional echocardiography for wall motion analysis was performed at the acute and chronic phase after acute myocardial infarction. We investigated whether there was mismatch area within non-infarcted myocardium and these patients were classified into the following two groups: 37 patients with mismatch (G+) and 94 patients without mismatch (G-). We checked out peak CK-MB, acute left ventricular ejection fraction (aEF), chronic EF (cEF), and improvement of EF (dLVEF = cEF-aEF).

**Result:** There were no significant differences of peak CK-MB, aEF and cEF between the two groups. Whereas, in (G+) group, only dLVEF was significantly higher than that of (G-) group (G+: 3.5  $\pm$  4.2 vs. G-: 2.8  $\pm$  3.9, p<0.005).

**Conclusion:** This study demonstrated that mismatch area within non-infarcted myocardium had improvement left ventricular functional outcome in optimal revascularized patients with acute myocardial infarction. And we proposed that mismatch area within non-infarcted myocardium might have association with ischemic preconditioning.

## 5.31

### <sup>123</sup>I-MIBG myocardial scintigraphy in patients with reversible ventricular dysfunction Takotsubo cardiomyopathy.

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**Background:** There have been a number of reports on a reversible form of left ventricular (LV) dysfunction with symptoms similar to those of acute myocardial infarction, but without coronary artery lesions even during the acute phase with ST-segment elevation. This type of ventricular dysfunction manifests abnormalities of the left ventricular wall motion, with apical akinesis and basal hyperkinesis. Another name for the disease in Japan, takotsubo cardiomyopathy (TC), describes the characteristic shape of the left ventricular asynergy. This study was designed to clarify the use of <sup>123</sup>I-MIBG myocardial scintigraphy in patients with TC.

**Methods:** Eleven consecutive patients with TC underwent cardiac catheterization on their first hospital day. The LV ejection fraction (EF) was calculated by the Simpson method. The left ventricular wall motion was monitored using echocardiography until the asynergy disappeared. The day after the wall motion was normalized, cardiac catheterization was performed again to provoke coronary vasospasm and calculate the normalized LVEF. Using <sup>123</sup>I-MIBG, scintigraphic images were obtained at the early phase (15min. after RI injection) and late phase (4hr) in patients with TC. The heart to mediastinum ratio (H/M) and washout ratio (WR) were calculated. The scintigraphy was performed within three days of the hospital admission (0M) and 3 month after the hospital discharge (3M).

**Results:** Coronary angiography revealed no significant stenosis in any of the patients. Although provocation tests for coronary spasm were performed after normalization of the wall motion, all cases were negative. Initial EF was 45.8 $\pm$ 9.1 %. LV contraction and EF were normalized in 21.5 $\pm$ 8.4 hospital days. Improved EF was 68.3 $\pm$ 7.6 % (p<0.0001). The decrease from early to late H/T was significant at 0M (2.10 $\pm$ 0.33 to 1.82 $\pm$ 0.29, p<0.001), but not at 3M. Late H/T improved significantly from 0M to 3M (1.82 $\pm$ 0.29 to 2.10 $\pm$ 0.28, p<0.0001). WR was accelerated significantly at 0M rather than 3M (43.3 $\pm$ 9.7% vs. 29.5 $\pm$ 10.0%, p<0.01).

**Conclusion:** The initial <sup>123</sup>I-MIBG myocardial scintigraphy in patients with TC effectively depicted the unique ventricular asynergy and had the potential to indicate the degree of cardiac sympathetic hyperactivity even when the coronary blood flow was maintained. These findings strongly suggested TC could be a consequence of neurogenic stunned myocardium.

## 5.32

### Do serum post-stress B-type natriuretic peptide levels correspond to left ventricular remodeling in myocardial infarction determined by gated myocardial SPECT?

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**Background:** B-type natriuretic peptide (BNP) is a neurohormone released from the ventricles of the heart in response to myocardial dysfunction. The goal of this study was to examine the relationship between left ventricular remodeling in anterior myocardial infarction using the analysis of stress-rest gated sestamibi myocardial perfusion SPECT (MPS) and the serum levels of BNP in pre-discharge stress test. **Methods:** 42 patients (32 men, mean age 67  $\pm$  11) with anterior acute myocardial infarction underwent serum BNP test in hospital 14 days before and after stress MPS. Patients with known valvular disease, non-ischemic cardiomyopathy, or respiratory failure were excluded. All patients were imaged again with MPS after 1 year. BNP > 100 pg/ml was defined abnormal in both rest and post-stress stage. Summed defect score and left ventricular endodiastolic volume (EDV), left ventricular ejection fraction (EF) were derived as previously described. Post-stress LV dilatation (PSD) was defined as > 10% elevation of post-stress EDV. LV remodeling was defined by both > 10% elevation of EDV and > 5% decrease of EF after 1 year compared to pre-discharge rest MPS study.

**Results:** LV remodeling after 1 year was observed in 18 patients (43%). The patients were divided into four groups, according to their post-stress serum BNP level and post-stress LV dilatation. Group I; abnormal BNP (> 100 pg/ml) and PSD positive: 12 pts, Group II; abnormal BNP and PSD negative: 10 pts, Group III; normal BNP and PSD positive: 8 pts, Group IV; normal BNP and PSD negative: 14 pts. There were no significant differences in age, gender, rest cardiac function and rest BNP level among four groups. LV remodeling after 1 year was observed in 12 pts (100%) of Group I, 4 pts (40%) of Group II, 2 pts (25%) of Group III and none of Group IV. The degree of LV remodeling in Group I was significantly higher than other groups. **Conclusion:** Left ventricular remodeling after 1 year of anterior myocardial infarction is associated with both an elevated level of BNP after stress test and post-stress left ventricular dilatation.

### 5.33

#### Impact of endothelial dysfunction on left ventricular remodeling after primary coronary angioplasty for acute myocardial infarction : analysis by quantitative ECG-gated SPECT.

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**BACKGROUND:** We hypothesized that endothelial cell integrity in the risk area would influence left ventricular remodeling after acute myocardial infarction.

**PATIENTS AND METHODS:** Thirty patients ( $61 \pm 8$  y.o.) with acute myocardial infarction underwent  $^{99m}\text{Tc}$ -tetrofosmin imaging in sub-acute phase and three months after successful primary angioplasty due to myocardial infarction. All patients were administered angiotensin-converting enzyme inhibitor after revascularization. Cardiac scintigraphy with quantitative gated SPECT were performed at the sub-acute stage and after 3 months after revascularization to evaluate left ventricular (LV) remodeling. The left ventricular ejection fraction (EF) and end-systolic and end-diastolic volume (ESV, EDV) were determined using a quantitative gated SPECT (QGS) program. In 3 months after myocardial infarction, all patients underwent the cardiac catheterization examination with coronary endothelial function testing. BK (0.2, 0.6, 2.0 micro g/min) were administered into the left coronary artery in a stepwise manner. Coronary blood flow was evaluated by the Doppler flow velocity measurement. Patients were divided into two groups by BK-response, endothelium-preserved group (EP) (n=10) and endothelial dysfunction group (ED) (n=10). **RESULTS:** At baseline, both global function and LV systolic and diastolic volumes were similar in both groups. However, LV ejection fraction was significantly improved in the EP group, compared with that in the ED group ( $42 \pm 10\%$  to  $48 \pm 9\%$ , versus  $41 \pm 4\%$  to  $42 \pm 13\%$  p<0.05). LV volumes progressively increased in the ED group compared to that of ED group ( $123 \pm 45$  ml to  $128 \pm 43$  ml, versus  $111 \pm 47$  ml to  $109 \pm 49$  ml, p<0.05).

**CONCLUSION:** In re-perfused acute myocardial infarction, endothelial function within the risk area plays an important role with left ventricular remodeling after myocardial infarction.

### 5.34

#### Inflammation imaging as a prognostic indicator and its relationship with CRP and inflammatory scintigraphy in chronic dissection of aorta.

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**Background:** The prognosis of chronic dissection of aorta (CDA) is believed to depend on the presence or absence of thrombus occlusion of the false lumen and the level of blood pressure control, but very few studies investigated these factors in terms of prognosis of the disease. Using indium-111-oxine labeled leukocyte scintigraphy (In-WBC), we have previously reported that a persistent inflammation develops in some cases during the chronic phase of CDA. In the present study, we assessed the relationship between CDA that was treated medically and its prognosis based on the In-WBC findings and blood inflammatory reactions.

**Method:** The subjects of the present study were 24 of these patients, who underwent medical treatment. The group was divided into a high risk group (H group) of 5 patients (3 patients had enlargement of the false lumen and 1 patient had retrograde dissection) with progressive focus during the chronic phase, and a low risk group (L group) of 19 patients having non-progressive focus. The subjects were examined and compared regarding the disease status during the chronic phase, the false lumen condition by CT, and the hematological findings. Also, we compared the accumulation and hematological findings of 10 patients (4 patients from the H group and 6 patients from the L group) who underwent In-WBC during the acute phase and chronic phase.

**Results and Discussion:** There was no difference between the two groups regarding the duration of hospitalization (H : L =  $34 \pm 3$  days :  $28 \pm 5$  days, ns.). CT scanning revealed no difference between the two groups concerning the rate of thrombus occlusion of the false lumen. There was no change in the CRP values during the acute phase and the values were maintained high. However, regarding the changes during the subacute phase (after day 14), the changes in the H group were significantly higher than those in the L group (p< 0.05). In the H group, the CRP values were high even in the subacute phase. Furthermore, the In-WBC study revealed that a persistent positive accumulation persisted during the chronic phase in all patients of the H group.

**Conclusions:** In the treatment of CDA, diagnostic imaging is commonly relied on, but monitoring of the changes in CRP from the acute phase to the subacute phase possibly provides advantages in the prognosis and in making the treatment plan. Furthermore, our results suggest that the In-WBC method accurately recognizes any persistent inflammation of the great vessels.

### 5.35

#### Imaging of fatty acid metabolism can express tacrolimus (FK506) impairment on myocardium with model rat and patients after renal transplantation.

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We investigated with a nuclear medicine approach using an animal model and patients after renal transplantation whether the detection of myocardial impairment due to FK506 were clarified.

**[Methods]** 1) animal protocol: With administration of FK506 or Ciclosporin (CYA), white rabbits were assigned to the control group (N), one-week administrate group (1W), two-week group (2W), and group subjected to one-month withdrawal following two-week administration (1M). After administration of  $^{201}\text{Tl}$ -thallium (TL) and  $^{123}\text{I}$ -BMIPP (BM), their accumulation rates per gram of the myocardium and pathological findings were compared. 2) patients protocol: 14 patients after renal transplantation who received FK506, the pre- and postoperative TL and BM accumulation and other findings were compared.

**[Results]** 1) CYA groups revealed no difference among the all findings. In the FK506 groups, no difference was observed in the TL rate. However, the BM rate decreased significantly in the 1W and 2W groups than in the N group (N : 1W : 2W =  $0.44 \pm 0.03$  :  $0.32 \pm 0.01$  :  $0.33 \pm 0.03$ , p<0.05 vs. N), whereas no differences in the BM accumulation rate were observed in 1M. Pathological findings for the FK506 groups showed myocardial interstitial edema and cellular infiltration in the 1W and 2W but only slight myocardial interstitial edema in the 1M. 2) Five of 14 patients caused cardiac symptom, left ventricular hypertrophy or changes of the electrocardiogram. Although 5 patients had decreasingly the perfusion by BM imaging, after administration of FK506, there were no change in TL imaging. The change of BM were improved after about one month.

**[Conclusion]** BM may contributes to the clarification of the myocardial impairment due to the FK506. It was suggested that this impairment was reversible.

### 5.36

#### Usefulness of distal protection using Percu-Surge during PCI to salvage myocardium in patients with AML.

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Though primary percutaneous coronary intervention (PCI) as a reperfusion therapy was useful to salvage myocardium in patients with acute myocardial infarction (AMI), there was a serious problem that distal emboli caused the no-reflow phenomenon. Recently, the device (Percu-Surge) to prevent distal emboli and aspirate emboli was developed. To clarify the effectiveness of that device, 30 patients (group A) (M/F=23/7, age= $64 \pm 12$  y) using Percu-Surge were compared with other 30 patients (group B) (M/F=22/8, age= $66 \pm 11$  y). PCI was successful in all patients. Tc-99m-pyrophosphate and Tc-99m-MIBI were done on subacute period. On 20 SPECT segments, the number of uptake segments of Tc-99m-pyrophosphate which was defined as the extent score (ES), the summed defect score (TDS) of Tc-99m-MIBI were calculated. LVEF and regional wall motion (WMS:-1=dyskinesis-4=normal) of AMI segments using MIBI-QGS were estimated at rest and during dobutamine (DOB) (5 microgram/kg/min). **Results:** There were no differences between 2 groups in age, gender, time to reperfusion, peak CPK, ES, TDS(MIBI), LVEF and WMS at rest and DOB. However, delta WMS(A:-1.6 $\pm$ 1.1 vs. B:-1.3 $\pm$ 0.9) was higher (p<0.05) than group B. Delta means the change of value. In conclusion, Percu-Surge could not improve myocardial perfusion and cardiac function in subacute period, but improved regional wall motion during DOB infusion, which suggests that Percu-Surge has possibility to improve cardiac function in the future.

### 5.37

#### **Superiority of 16 frame ECG-Gated FDG PET to 8 frame study for the evaluation of left ventricular function: comparison with echocardiography.**

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**Background:** There have been very few studies regarding diagnostic value of 16-frame ECG-gated Positron Emission Tomography (PET) using 18F-fluorodeoxyglucose (FDG) in order to evaluate the left ventricular contractile function although it is a common method for myocardial perfusion SPECT. To elucidate the value of 16-frame ECG-gated FDG PET, estimates of left ventricular contractile function by this method was compared to those by 8-frame ECG-gated FDG PET, and then those by echocardiography. **Methods:** 55 patients including 44 ischemic heart disease, 9 cardiomyopathy and 2 normal subjects were enrolled to this study. FDG was intravenously administered to all the patients at 1 hour after 75g oral glucose loading. ECG-gated FDG PET images were acquired for 15 minutes at 16 frames per cardiac cycle. PET images were then re-binned to 8 frames per cardiac cycle. End-diastolic volume (EDV) and end-systolic volume (ESV) of left ventricular volume and ejection fraction (EF) were automatically calculated both for 16- and 8-frame PET images with QGS software modified for PET. Echocardiography was performed for all patients to measure same indices by modified Simpson's method. Absolute errors were calculated for each method as the differences in the ejection fraction by 8- and 16-frame PET and by echocardiography. **Results:** EDV, ESV and EF measured by echocardiography ranged widely from 54 to 355ml, 21 to 302ml, and 18 to 75%, respectively. End-systolic volume by 16-frame PET was smaller than those by 8-frame PET in all the cases ( $p<0.0001$ ), whereas end-diastolic volume was similar, resulting in greater ejection fraction by 16 frame PET compared to 8-frame PET ( $p<0.0001$ ). Compared to echocardiography, absolute errors of ejection fraction by 16-frame PET was 8%, whereas those by 8-frame PET was 17%. Standard deviation of absolute errors was similar. **Conclusion:** 16-frame FDG PET was considered to be superior to estimate cardiac volume and function compared to 8-frame FDG PET.

### 5.38

#### **Quantitation of myocardial blood flow reserve by means of consecutive myocardial blood flow measurements using split-dose of TI-201 in pig SPECT study.**

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The quantitative measurement of myocardial blood flow (MBF) can be achieved by TI-201 dynamic SPECT and kinetic analysis using appropriate model. Long physical half-life and slow kinetics of TI-201, however, have made it difficult to measure MBF at baseline and pharmacologically stressed states within a short interval, which is useful for estimating MBF reserve (MBFR). In this study, we present a new split-dose protocol and kinetic model that allow sequential and quantitative MBF measurements at two different states. Dynamic acquisition was performed on miniature pigs ( $n = 7$ ), using a single-head SPECT camera (GCA-7100A, Toshiba, Japan) and a protocol that was composed of two sequential dynamic scans for baseline and stress states. The both dynamic scans were acquired for 30 min with TI-201 injection, respectively. With completing the first scan of baseline, pharmacologically stressed state was induced by CGS-21680 (adenosine A2A selective agonist) injection, before the second dynamic scan. Arterial blood samples were obtained during both the dynamic acquisition. Radiolabeled microsphere of Cr-141 and Cr-51 was injected, respectively, at the same time as TI-201 injection for the both scans. Dynamic images were generated by OSEM reconstruction, incorporating the corrections of attenuation and scatter. Regional time-activity curve (TAC) was used for the estimation of both MBF values. The baseline MBF value in SPECT (MBF(1st-SPECT)) was estimated using a conventional 2-compartment model fitting. Background activity at the time of the second TI-201 injection was estimated with the kinetic values obtained from the first MBF estimation. And, the stress MBF value was estimated using 2-compartment model modified for background activities in the second scan data (MBF(2nd-SPECT)). MBFR was calculated by  $(\text{MBF}(2\text{nd}) - \text{MBF}(1\text{st})) / \text{MBF}(1\text{st})$ . The values of MBF and MBFR were compared between SPECT and microsphere. The value of MBF by microsphere (MBF(MS)) was  $0.60 \pm 0.15$  ml/g/min for baseline and  $1.64 \pm 0.52$  ml/g/min for stress states, respectively. The presented kinetic model provided the good fitting in the MBF(SPECT) estimation using single TAC of sequentially acquired SPECT data. The estimated values of MBF(SPECT) were showed good correlation ( $r = 0.83$ ) with MBF(MS). There is no significant difference of MBF and MBFR between SPECT and microsphere. The presented TI-201 split-dose method could provide quantitative values of MBF at different states within shortened scan period (~1 hr). This method may be useful for assessing MBFR accurately and less invasively in heart disease patients.

### 5.39

#### **Distinct discrepancy between Thallium and BMIPP scans promises LVEDV and LVEF improvement.**

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**Background:** Discrepancy between thallium and BMIPP scans at acute phase of myocardial infarction is known to show the risk area of development of ischemic event in the future. However, the correlation between the discrepancy and the prognosis of left ventricular function is not clear. The aim of this study is to clarify the correlation between the discrepancy and the prognosis of left ventricular function. **Methods:** Seventy-eight cases, with acute anteroseptal myocardial infarction who underwent Thallium and BMIPP ECG gated dual SPECT at acute phase and three months after the onset, were investigated. Cases were divided into three groups according to the ratio of discrepancy/BMIPP defect score size; group A with ratio zero, group B with ratio between 0.06 and 0.38, and group C with ratio between 0.4 and 1. Left ventricular end-diastolic volume (LVEDV) and left ventricular ejection fraction (LVEF) at acute and chronic phase were compared. **Results:** In group A, LVEDV at acute and chronic phase were  $88.3 \pm 18.3$  and  $93.0 \pm 33.0$  ml (n.s.), and LVEF were  $42.0 \pm 18.0$  and  $49.0 \pm 14.0$  % (n.s.). In group B, LVEDV at acute and chronic phase were  $102.0 \pm 32.1$  and  $91.0 \pm 31.0$  ml (n.s.), and LVEF were  $41.0 \pm 13.0$  and  $49.0 \pm 13.0$  % (n.s.). On the contrary, group C showed significant improvement of LVEDV (from  $85.3 \pm 27.5$  to  $76.0 \pm 24.0$  ml,  $p<0.05$ ) and LVEF (from  $45.4 \pm 15.0$  to  $54.0 \pm 10.0$  %,  $p<0.05$ ). **Conclusion:** We may presume that discrepancy between Thallium and BMIPP at acute phase of anteroseptal myocardial infarction can predict the improvement of LVEDV and LVEF at chronic phase.

### 5.40

#### **Thallium quantitative gated SPECT at acute phase of anteroseptal myocardial infarction can predict possibility of future improvement of left ventricular size and ejection fraction.**

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**Background:** Thallium quantitative gated SPECT (TI-QGS) is well known to have a strong diagnostic power of myocardial ischemia. However, the predictive possibility of left ventricular (LV) remodeling in the future is still unclear. We investigated the prediction possibility of LV remodeling in chronic phase of anteroseptal myocardial infarction (ASMI) using TI-QGS in the acute phase. **Methods:** Sixty-seven cases with acute ASMI underwent TI-QGS at the acute phase and three months after the onset. Cases were divided into two groups according to the size of defect score (DS) of TI-QGS; group L with DS greater than 10 and group S with DS smaller than 9. LV end-diastolic volume (LVEDV) and LV ejection fraction (LVEF) between two phases were compared for each group. **Results:** LVEDV of group S decreased from acute to chronic phase (from  $87.3 \pm 29.2$  to  $75.5 \pm 23.4$  ml,  $p<0.05$ ). LVEF of group S recovered from  $44.6 \pm 14.6$  to  $54.8 \pm 11.1$  %. However, LVEDV of group L showed no change in the same period ( $105.3 \pm 21.7.0$  and  $107.0 \pm 29.5$  ml, n.s.), and LVEF group L were  $37.9 \pm 10.5$  and  $41.6 \pm 9.9$  %, n.s. **Conclusions:** We presumed that TI-QGS at acute phase of ASMI can predict possibility of LV size reduction and LVEF recovery at chronic phase.

## 5.41

### Effects of percutaneous coronary interventional therapy in chronic total coronary occlusion in patients with no history of MI.

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Percutaneous catheter interventional therapy (PCI) has been recently well improved as a strong tool to re-canalize the stenosed coronary arteries for the patients with angina pectoris by the development of a new device or progress of techniques. However, the patients with chronic total coronary occlusion (CTO) are a subset with many difficulties to do PCI due to the trouble of recanalization of hard coronary plaques and many re-stenosis of a blockade part. Therefore, the rationale to perform PCI to the CTO remains unknown.

**Purpose:** The aim of this study was assess the effects of the PCI in patients with CTO and no prior myocardial infarction (MI) using Tc-99m-tetrofosmin SPECT.

**Method:** The study included 18 patients with CTO of the left anterior descending artery and 13 patients with 90 % stenosis of the same artery who had undergone gated myocardial perfusion SPECT at rest using Tc-99m-tetrofosmin before and 6 months after PCI. None of them had prior history of MI. Regional myocardial perfusion in 17 segments was scored using a 4-point grading system. The summed rest score (SRS) were calculated as total number of areas with abnormal myocardial perfusion. We compared the SRS and the ejection fraction(EF) before and after PCI and evaluated the relation between them.

**Results:** CTO group had a higher frequency of reduced EF as compared with those of the stenosis group. ( $46 \pm 17\%$  vs.  $63 \pm 11\%$  [ $P=0.02$ ]) on gated SPECT.

The myocardial perfusion imaging of the CTO group showed more severe perfusion abnormalities (SRS of  $6.3 \pm 5.6$ ) than that in the stenosis group (SRS of  $0.4 \pm 1.0$ ) [ $P=0.02$ ]. After successful PCI, the EF of CTO group improved ( $51 \pm 12\%$ ) [ $p=0.02$ ], whereas those of stenosis group remained normal ( $62 \pm 11\%$ ) [ $p=NS$ ]. SRS of the CTO group were significantly improved after PCI (from  $6.3 \pm 5.6$  to  $3.4 \pm 3.4$ ) [ $p=0.01$ ] whereas SRS of the stenosis group remained normal after PCI (from  $0.4 \pm 1.0$  to  $0.0 \pm 0.0$ ) [ $p=NS$ ].

**Conclusion:** In patients with CTO, both myocardial perfusion and cardiac function were reduced before PCI, indicating greater myocardial damages than those with 90% artery stenosis. On the other hand, successful PCI significantly improved resting perfusion and function in those with CTO. Thus, PCI is strongly recommended for patients with CTO.

## 5.42

### Delayed heart rate recovery after treadmill test: comparison with clinical, exercise and myocardial perfusion parameters.

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**Background:** Imbalance between sympathetic and parasympathetic tone and excessive stimulation of the sympathetic nervous system are fundamental risk factors for cardiac death. Recent studies reported abnormal heart rate recovery (HRR) after the treadmill exercise test is a powerful and independent predictor of significant excess mortality. To evaluate HRR as an index of coronary artery disease, we have compared perfusion defect.

**Material and Methods:** 252 patients (147 men, 58.33%) underwent exercise myocardial perfusion imaging with symptom-limited Bruce protocol were included. The value for HRR was defined as the decrease in heart rate from peak exercise to 1 minute after termination of exercise. Myocardial perfusion imaging was acquired at 1 hour after 740MBq 99mTc-MIBI intravenous injection using dual head gamma camera (Vertex Plus, ADAC, USA). Summed stress score (SSS) and stress ejection fraction (sEF) were obtained from AutoQUANT program. Twenty-three beats/min was defined as the lowest normal value for HRR by our normal data. Patients were divided two groups: abnormal HRR (abHRR) and normal HRR (nHRR) by the lowest normal value for HRR. We compared clinical (age, sex, previous coronary disease history, diabetes, hypertension), exercise test (exercise capacity, exercise duration) and myocardial perfusion parameters (SSS, sEF) between two groups. Results : The mean value of HRR in the our normal data was mean 50.8 and SD 4.2 beat/min. There were 25 patients (9.9%) with an abnormal HRR. Patient with abHRR were generally in older age (61.5vs 54.4yrs old), were more likely men (72 vs 56.8%), had a higher frequency of diabetes (16.7 vs 9%), hypertension (52 vs 27.6%) and coronary artery disease history (28 vs 7%) compared to nHRR. In exercise parameters, abHRR were showed more positive result (60 vs 30%) and had short exercise duration (7.0vs 9.1min) and small exercise capacity (7.2 vs 10.0 Mets) compared to nHRR. In myocardial perfusion parameters, abHRR had a higher frequency of coronary artery disease (76 vs 41.4%) and multivessel disease (25 vs 6.5%), had larger SSS (8.1vs 3.7) and had smaller sEF (47.7vs 57.9%) compared to nHRR.

**Conclusion:** Abnormal HRR was frequently found in patients with coronary disease, large myocardial perfusion defect and decreased left ventricular function. It seems that the HRR value 1 minute after peak exercise may be considered a reliable index of the severity of coronary disease.

## 5.43

### Right ventricular function after acute myocardial infarction: dependence upon infarct-related coronary artery.

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The right and left ventricular function after a first myocardial infarction was assessed ECG-gated blood pool (GBP) single photon emission computed tomography (SPECT) (GBPS) algorithms (Cedars-Sinai Medical Center, Los Angeles, Calif) (12 after LAD related infarction (group 1) and 15 after RCA related infarction (group 2)). The left ventricular ejection fraction, end-diastolic volume and end-systolic volume did not differ significantly between the groups (LVEF=50.8% vs 55.1%. LV EDV=73.2 vs 79.7 ml, LVESV=38 vs 44ml :  $P>0.05$ ), but right ventricular ejection fraction end-diastolic volume and end-systolic volume were significantly depressed after anterior myocardial infarction (LVEF=57.3% vs 46.3%. LV EDV=56.4 vs 95.1 ml, LVESV=25.6 vs 54.6ml :  $P<0.05$ ). There was evidence of right ventricular dilatation in the group with RCA related infarction. Six with inferior infarction had abnormal right ventricular ejection fractions (<40%). The relation between right and left ventricular ejection fractions was markedly different in the two groups. In the group with RCA related infarction there was a significant linear relation between right and left ventricular ejection fraction ( $R=0.5$ ), whereas in the group with LAD related infarction there was not ( $R=-0.3$ ). Thus right ventricular dysfunction commonly occurs after RCA related infarction. Right ventricular impairment are related after RCA related infarction, but are independent after LAD related infarction. Finally, the different effects of LAD and RCA related infarction on right ventricular function may be explained by site of the myocardial wall involvement after infarction.

## 5.44

### Prognosis and risk stratification of diabetic patients after coronary stenting: impact of silent ischemia on cardiovascular events.

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**Aims:** We want to evaluate the role of myocardial perfusion scintigraphy (MPS) in risk stratification and prognosis in diabetic patients (pts) after coronary artery stenting and to compare those results in non-diabetic pts. Special interest was the impact of diabetes on clinical and scintigraphic indicators of restenosis and incidence of silent ischemia. Materials and methods: We have evaluated 52 pts (29 male and 13 female, age  $57 \pm 8$ ) after coronary stenting, 31(59%) pts were diabetics for more than 5 years. Stent location was 61% LAD, 15% LCx and 24% RCA. Pts were followed up for 9 months after the stenting when Tc-99m sestamibi Gated SPECT MPS was performed. We have used 20-segment analysis with 5 point scoring system (0=normal; 4=no uptake). Semiquantitative analysis was done using summed stress score (SSS), summed rest score (SRS) and summed differential or reversibility score (SDS). Reversibility in a stent related coronary artery territory on semiquantitative assessed SPECT study was defined as restenosis indicator. Severity of CAD was estimated using angiographic Gensini score.

**Results:** Nine months after the stenting 12 pts (24%) had target vessel ischemia, which was silent in 47%. MPS find inducible ischemia in 64% LAD, 9% LCx and 27% RCA artery territories. Pts with target vessel ischemia had average SSS 6.7 vs. 4.2 and lower post stress LVEF ( $p<0.05$ ) comparing to the pts with out inducible ischemia ( $p<0.01$ ) The prevalence of silent ischemia was higher in diabetic pts -7/12 pts ( $p<0.05$ ). They also had higher SSS-10.3 vs. 5.2 in non-diabetic pts ( $p<0.01$ ) and SDS-3.7 vs. 2.5 ( $p<0.05$ ). Average Gensini Score was 64.8 in diabetics vs. 49.7 in non-diabetic pts. There was no difference in presence of transit ischemic dilatation (TID). We have not registered any cardiac death or myocardial infarctions. 3 of 12 pts with target vessel ischemia and average SSS>6 had unstable angina and hospitalization in the follow up period. 2 of them were diabetics. No correlation was found between silent ischemia and duration of diabetes.

**Conclusion:** MPS is a valuable method for detection of ischemia and evaluation of prognosis in both diabetic and non-diabetic patients. Diabetics had more frequent silent myocardial ischemia after stenting, which predicted more cardiac events than did no ischemia. This was closely related to the extent of ischemia indicating the value of MPS for risk stratification after stenting, especially in diabetic patients as a high-risk population.

## 5.45

### Initial experience in Mexico of 18-FDG PET compared with thallium SPECT in the assessment of myocardial viability.

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In patients with myocardial infarction and left ventricular dysfunction, the evidence of myocardial viability is primordial. There are some methods to detect the presence of myocardial viability, 201-thallium reinjection SPECT protocol represents the most common radioisotopic technique to evaluate it. Positron emission tomography (PET) using FDG is considered the gold standard. Objective: The aim of this study was to compare globally and by segments the value of both techniques in the detection of viable myocardium.

**Methods:** Twenty-six consecutive patients with previous myocardial infarction and left ventricular dysfunction were studied. All of them underwent into a SPECT perfusion scan and a FDG PET study to assess myocardial viability. Each study was performed in less than one week between the other. For the analysis, the myocardium was divided into 17 segments. A visual semi-quantitative analysis was carried out according to the following score indicating radiotracer uptake: 0=normal to 4=absent. Myocardial viability was defined as the presence of normal, mildly or moderately reduced radiotracer uptake. The scores obtained by PET were compared to those obtained in SPECT. A T Student and Chi square tests were used for the quantitative and qualitative variables respectively, statistical analysis was performed using the SPSS v. 10 program.

**Results:** 442 segments were analyzed. PET detected viability in 134 segments that had been defined as non-viable by SPECT. No differences in the analysis by vascular territories were found. Thirty percent of the segments that were defined as non viable by SPECT were viable by PET, meanwhile only 1% of the segments detected viable by SPECT were considered non viable with PET. (Table 1)

**Conclusions:** FDG PET study represents a better technique to detect myocardial viability, compared to thallium reinjection SPECT protocol. By this study we have demonstrated that 3 of each 10 studies may be diagnosed as non viable where viability is present.

#### PET vs SPECT in Myocardial Viability

		PET	
		Viable	Non Viable
SPECT	Viable	252 (57%)	5 (1.13%)
	Non Viable	135 (30%)	50 (11.3%)

## 5.46

### Cardiac denervation early after transmural CO<sub>2</sub>-laser revascularisation in I-123-MIBG planar and SPECT studies.

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**Aim:** to study the range of changes caused by transmural CO<sub>2</sub>-laser revascularisation [TMLR] in cardiac adrenergic nervous system [SYSTadren].

**Material and methods:** forty-seven pts were studied for neuronal activity and integrity with I-123-MIBG planar and SPECT imaging before [MIBG-0] and 7-21 days after cardiac surgery [MIBG-early]. Sole laser revascularisation was performed in 23 pts and laser revascularisation concurrent with 1 bypass was performed in 24 pts. The group characteristics: 37 M (79%); age: 43-76 (av.63); LVEF 30-70 (av.53); III/IV CCS class. During the surgery, 15-32 (av.23) channels were generated in myocardium. Registration of I-123-MIBG planar images was started 3.5 hrs and of SPECT images was started 4 hrs after injection of the radiopharmaceutical. In planar studies, global activity of SYSTadren was measured by heart/mediastinum index [H/M]. In SPECT studies, regional MIBG uptake was assessed in 17 segments [seg] of the LV; 4-grade intensity scale was applied (0=normal uptake, 3=severe defect). Summarized MIBG uptake deficiency in SPECT was expressed by summary defect score [SDS].

**Results:** in total, in MIBG-early, uptake was deteriorated in 42% of seg (95% confidence interval CI=38-46%) and was improved only in 10% (CI=8-12%). In septal segments non-revascularised by CABG (nor by laser), uptake was deteriorated in 23% of seg (CI=16-32%) and was improved in 13% (CI=8-21%, NS). In lased segments, uptake was deteriorated in 48% of seg (CI=43-53%) and was improved only in 8% (CI=6-11%). In bypassed segments (which were also lased, in a part), uptake was deteriorated in 38% of seg (CI=30-48%) and was improved in 13% (CI=7-20%). In the group of lased pts, SDS has deteriorated from 23±6 to 29±5 (p<0.001) and H/M has decreased from 2.01 to 1.68 (p<0.0001). In the group of lased-and-bypassed pts, SDS has deteriorated from 20±6 to 25±7 (p<0.006) and H/M has decreased from 1.77 to 1.61 (p<0.003). Significant clinical improvement was observed in evaluated pts.

**Conclusion:** early after TMLR, the integrity and activity of SYSTadren is deteriorated, what can be a mechanism responsible for clinical improvement observed early (< 3 weeks) after TMLR.

## 5.47

### Myocardial perfusion Tc99m MIBI SPECT and multislice computed tomography (MSCT) in the assessment of the results of chronic total coronary occlusion (CTO) angioplasty.

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Restenosis assessment in patients after CTO recanalization is often difficult due to frequent, well developed collateral circulation and scar in the area of myocardial infarction. The aim of the is to evaluate the role of MIBI SPECT and MSCT in assessment of restenosis after successfully recanalized and stented CTO. 44 patients underwent successful PCI and stent implantation of CTO 29 (72.5%) patients had myocardial infarction in the occluded artery area. In 16 (40%) patients-left anterior descending (LAD), 8 (20%)-circumflex (Cx) and 16 (40%)-right coronary artery (RCA) were recanalized. MIBI SPECT revealed reversible perfusion defect in all patients before recanalization. MIBI SPECT and MSCT of coronary arteries at 6 and 12 months were done. Patients free from symptoms and with negative results of exercise test, MIBI SPECT and MSCT were assumed non-restenotic. Results of SPECT and MSCT were compared to angiographic ones Results: Mean follow-up time was 19±9.9 (3-42) months. Restenosis was detected in 16 patients, but in 2-neither scintigraphy, nor MSCT was performed. Positive MIBI SPECT was observed in 11 (78.6%), and MSCT in 9 (64.3%). In 2 (14.2%) Sensitivity, positive and negative predictive values were 78.6%, 78.6% and 62.5%MIBI SPECT, respectively, whereas MSCT showed sensitivity of 64.3%, positive predictive value of 81.8% and negative predictive value of 50.0%. Conclusions: Restenosis rate accounted for 40%. Both MIBI SPECT and MSCT facilitated detection of restenosis, although SPECT showed higher sensitivity and negative predictive value, as compared to MSCT.

## 5.48

### Percutaneous myocardial laser revascularisation-scintigraphic and echocardiographic assessment of the results.

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**Background:** Percutaneous myocardial laser revascularisation (PMR) is a novel therapeutic technique aimed at delivering oxygenated blood via a series of channels made by percutaneous approach to the ischemic regions of the heart. In patients with the end stage coronary artery disease PMR is associated with a reduction in symptoms, improved exercise tolerance and enhanced quality of life. The study aimed to assess perfusion in the PMR patients in the long-term follow-up, with a view to establishing possible correlation with their clinical improvement.

**Material and methods:** 24 patients aged 46-74 years, mean 62 years, with chronic coronary artery disease were enrolled into the study. All of them were referred to the PMR procedure based on the standard criteria. At baseline (one week prior to the procedure), after 3 and 15 months after PMR all patients underwent myocardial gated perfusion scintigraphy (GSPECT), and echocardiography with dobutamine stress test. The collected data were analyzed using the ANOVA and Pearson's correlation test.

**Results:** In the long term follow-up in the entire group a deterioration, or no changes in perfusion in the areas reperfused by PMR, were observed, although without any statistical significance. Due to the progression of chronic CAD in the long term follow-up we observed deteriorated perfusion in the other, non-reperfused areas, mainly in LAD region. EF measured by GSPECT decreased during the follow-up (48.89±14.58 at baseline vs. 43.7±26.94 at 3 months, and vs. 42.97±23.28 at 15 months), although it lacked statistical significance. In stress echocardiography mean WMSI decreased significantly from 1.71±0.24 before PMR down to 1.55±0.21 at the early and long-term follow-up. At long-term follow-up mean echocardiographically estimated EF was 52.7±8.3% and not significantly different from baseline. These changes were accompanied by significant increase of mean CCS score from 2.54±0.78 before the procedure to 3.52±0.51 (P<0.0001) 1 month after, and subsequently by a decrease of 2.78±0.65 in the long-term follow-up.

**Conclusions:** Since our study failed to demonstrate any improvement whatsoever in perfusion, nor in ventricular function after laser revascularization, it may be reasonably assumed that the clinical benefits of PMR were in fact largely due to the placebo effect of the procedure itself. Admittedly, a relatively small group of patients was assessed and therefore larger trials are still required to establish the practical value of this technique.

## 5.49

**Risk factors and myocardial viability testing with perfusion scintigraphy may imply the treatment of the ischemic left ventricular dysfunction(ILVD)-the results from the registry long-term follow-up**

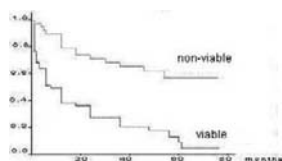
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The value of the viability testing in view of the clinical characteristics of "real-life" registry patients (pts) with ILVD is unknown. The aim of the study was to define the subgroups of pts, in whom myocardial perfusion scintigraphy result may suggest the treatment or prevention strategy.

**Methods:** 172 consecutive pts (130 males, mean age 60±17) with ILVD (mean ejection fraction of 0.38 ± 0.12) subjected to TI-201 SPECT imaging (130 MBq rest-redistribution) or Tc-99m ECG-gated SPECT (740 MBq at rest) were analysed. The significant viability was defined as the presence of reversible defect or the uptake >50% and the preserved systolic thickening in more than 1 (out of 16) dysfunctional segment. The primary and secondary end-points (SEP) were the overall mortality and major adverse cardiovascular events (MACE) including revascularization procedures respectively.

**Results:** The average follow-up was 76±16 months. 40 pts (23%) died, 43% experienced the SEP. The mortality was influenced by the risk factors, no beta-blocker (26%) or acetylsalicylic acid (36%) treatment and poor physical activity (56%). The viable myocardium (57% of pts) was more frequent in pts with SEP (i.e 0% vs 18% for the brain stroke, P<0.02). The survival analysis is shown below. In pts with viable myocardium the revascularization procedures improved the survival (20±3.5 vs 58± 5.3, P<0.002) and halved the risk for the stroke. The pts with viability had more hospitalizations.

**Conclusion:** In registry patients with ischemic left ventricular dysfunction and viable myocardium the revascularization may improve the outcome. The registry data indicate the need to improve the compliance with the secondary prevention measures, especially in patients with viable myocardium.



Event-free survival

## 5.50

**Chronotropic index and heart rate recovery in patients with familial amyloidotic polyneuropathy. Correlation with I-123 metaiodobenzylguanidine cardiac imaging and heart rate variability.**

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Impaired heart rate (HR) response to exercise measured by chronotropic index (CI) and delayed heart rate recovery (HRR) are reflective of autonomic tone and have been shown to predict cardiac mortality. Familial amyloidotic polyneuropathy (FAP) type I is characterized by polyneuropathy and progressive dysfunction of the autonomic nervous system. The aim of this study was to determine CI and HRR in FAP patients (pts) and to correlate these measures with other parameters of autonomic nervous system.

**Methods:** 20 pts with TTRVal30Met mutation (10 male; age=39.5±13 yrs) presenting with different stages of the disease (11 with electromyographic changes) and 20 age-matched healthy control subjects underwent symptom-limited exercise test according to Bruce protocol. CI was defined as (peak HR-rest HR)/(220-age-rest HR), with CI ≥.8 normal. HRR was defined as the difference between peak HR and HR one minute later. A HRR 22 bpm was considered abnormal. FAP pts also underwent heart rate variability (HRV) analysis and I-123 metaiodobenzylguanidine (MIBG) myocardial imaging.

**Results:** heart-to-mediastinum MIBG uptake was 2.04±0.4 (normal value=2.6±.3). Exercise variables are shown in table. CI was decreased in 14/20 FAP pts and in only 1/20 normal subjects (p<.0001). HRR was abnormal in 11 pts and in 2 subjects of the control group (p=.007). CI and HRR did not correlate with electromyographic severity of the disease nor with MIBG uptake. Significant correlations were observed between HRR and total power (r=.57, p=.007), LF (r=.58, p=.007) and HF (r=.58, p=.007).

**Conclusions:** CI and HRR are simple exercise parameters that are decreased in FAP pts and may be useful to identify autonomic dysfunction early in the course of the disease and to select pts for liver transplantation, which is the only way to control the progression of the disease.

**Exercise variables**

	FAP patients (n=20)	Normal subjects (n=20)	p value
Resting HR (bpm)	93 ± 15	81 ± 9	.002
Peak HR (bpm)	151 ± 23	174 ± 15	.0004
Exercise duration (sec)	549 ± 150	693 ± 110	.001
HR in 1st min of recovery (bpm)	129 ± 21	135 ± 18	ns
IC	.66 ± .22	.92 ± .08	<.0001
HRR	22 ± 12	40 ± 14	<.0001

## 5.51

**Validation of Cedars quantitative perfusion SPECT (QPS) in our department: comparison with visual interpretation.**

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**Aim:** The aim of this study was to assess the agreement between the quantitative and the visual analysis of myocardial perfusion scintigraphy.

**Methods:** We included 72 patients (50 men, 22 women, mean age of 60± 11,6 years) who underwent a one day stress-rest 99mTc-Tetrafosmin myocardial SPECT. Forty two patients had history of documented myocardial infarction. Perfusion images were divided in 20 segments assigned to six evenly spaced regions in apical, mid-ventricular and basal slices of the short axis and 2 apical segments of the mid-ventricular long axis slice. Each segment was scored by visual analysis from normal perfusion (0) to severely reduced perfusion (4), the stress summed score (SSS), the rest summed score (RSS) and the difference summed score (DSS) were calculated. Automatic quantification was done using QPS software, based on a 20 segment left ventricular model and scoring each segment from normal perfusion (0) to severely reduced perfusion (4) and automatic SSS, RSS and DSS were obtained. Linear regression and analysis of differences between both methods was done. Summed scores obtained by visual and by automatic quantification were classified according to severity (E3: normal; 4-9: moderate; <sup>3</sup>10: severe) and agreement between classification was determined.

**Results:** A good correlation between visual and automatic scores was obtained.

SSS: visual and QPS-R=0,957; SEE: 2,8

RSS: visual and QPS-R=0,927; SEE: 3,1

DSS: visual and QPS-R=0,648). SEE: 2,6

The mean differences found between visual and automatic scores were small.

SSS: mean difference visual-QPS = 0,41;

RSS: mean difference visual-QPS= 1,2;

DSS: mean difference visual-QPS = 0,3

There was a good agreement between automatic and visual classification of scores according to severity.

SSS: kappa = 0,72;

RSS: kappa = 0,73

DSS: kappa = 0,59.

**Conclusions:** Quantification of myocardial perfusion scintigraphy is known to be a well established technique. Also in our department QPS showed to be a reliable software for the quantitative evaluation of myocardial perfusion scintigraphy.

## 5.52

**Prognostic value of cardiac scintigraphy in patients with left bundle branch block.**

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**PURPOSE:** To evaluate the prognostic value of perfusion scintigraphic patterns in left bundle branch block (LBBB).

**POPULATION:** 310 consecutive patients (Pt), 128 male and 182 female, mean age 65 years, old with LBBB referred to cardiac scintigraphy were studied.

**METHODS:** Clinical history, pharmacologic adenosine stress cardiac scintigraphy (SPECT) and rest SPECT with technetium-99m and clinical follow-up for cardiac events (CE) were performed. CE were defined as, myocardial infarction, unstable angina, severe heart failure, coronary surgery, coronary angioplasty and cardiac death.

**RESULTS:** Clinical Profile: Hypertension- 144 Pt; treated diabetes- 36 Pt; treated dyslipidemia- 57 Pt; active smokers- 26 Pt; Menopause- 150 Pt; more than 2 CAD risk factors- 78 Pt; angina- 109 Pt; atypical chest pain- 41 Pt; congestive heart failure- 12 Pt; asymptomatic- 148 Pt;

**Scintigraphic Pattern:** No perfusion defects (PD)- 102 Pt (49.2%); perfusion defects- 105 Pt(50.8%): 95 Pt- septal (45 septal only), 60 Pt- other localization.

**Clinical follow-up:** 207 Pt were followed for a mean period of 20 months (103 Pt lost for follow-up). 51 Pt had cardiac events (24.6%): 3 myocardial infarction, 3 unstable angina, 9 cardiac heart failure, 12 coronary surgery, 18 coronary angioplasty and 6 cardiac death.

Cardiac scintigraphy data (presence, type and localization of PD) were correlated to the occurrence of CE (table 1) and statistically analysed (chi-square test): Relation PD/events- p<0.001; relation PD reversibility/events- p<0.0001; relation PD localization/events- p<0.0001.

**Conclusion:** I- This LBBB population presented perfusion defects in half of the cases and cardiac events at 20 months in 25%.

2- Patients with perfusion defects developed more cardiac events (42%).

Reversibility and localization besides the septal wall were associated to more frequent cardiac events (65% and 70%, respectively).

3- Patients without perfusion defects in the scintigraphy had good prognosis (94% free of events). Also, perfusion defects exclusively in the septal wall and fixed defects were predictive of good prognosis (respectively, 6 and 8% events).

Table 1

	PD	no PD	reversible	fixed/no defect	only septal	other localization
EVENTS	45	6	39	12	3	42
NO EVENTS	60	96	21	135	42	18

Scintigraphic data and cardiac events correlation

## 5.53

### Evolution of left ventricular systolic function after coronary revascularization and medical treatment in patients with ischemic cardiomyopathy.

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The aim of the study was to analyzed, by means of gated SPECT, the effect of coronary revascularization and medical treatment on left ventricular remodelling in patients with coronary artery disease and impaired left ventricular systolic function.

**Methods.** We studied 61 patients (mean age:  $60 \pm 10$  years, 6 female) with ischemic cardiomyopathy (LVEF  $< 40\%$ ) who had two gated-SPECT myocardial perfusion studies with technetium labeled compounds during a follow-up more than 3 months: 30 were revascularized (group A) (24 with CABG and 6 with PTCA; follow-up:  $23.5 \pm 13$  months) and 31 followed with medical treatment (group B) (follow-up:  $19.7 \pm 16$  months).

**Results.** Seventy-three percent (22/30) of the patients of the group A and 38.7% (12/31) of the patients of the group B satisfy scintigraphic viability criteria ( $p < 0.006$ ). Fifty-seven percent (17/30) of the patients of the group A and 19% (6/31) of the patients of the group B showed a significant improvement of LVEF (LVEF  $> 5\%$ ,  $p < 0.003$ ) between the first and second study. In patients of group A, a significant reduction in end-systolic volume (ESV) and a significant increase in LVEF were observed, while in patients with medical treatment the differences were not significant.

#### Picture Results.

**Conclusions.** Patients with coronary artery disease and reduced left ventricular function who are revascularized showed statistically significant decrease in ESV and improvement in LVEF.

This fact was not observed in patients who were followed with medical treatment.

Table 1

	Revascularization			Medical treatment		
	Pre	Post	p	1st study	2nd study	P
LVEF (%)	$28 \pm 6$	$38 \pm 12$	0.000	$30.6 \pm 7$	$32.4 \pm 9$	0.10
EDV (ml)	$182 \pm 59$	$173 \pm 67$	0.40	$190 \pm 68$	$184 \pm 76$	0.35
ESV (ml)	$132 \pm 48$	$111 \pm 58$	0.03	$133 \pm 54$	$128 \pm 59$	0.37

## 5.54

### Clinical management of patients with coronary artery disease and reduced left ventricular ejection fraction with and without viability in gated-SPECT.

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The aim of this study was to analyze the clinical management of patients with coronary artery disease and reduced left ventricular systolic function with and without scintigraphic viability criteria.

**Methods.** During 6 years, 206 consecutive patients (mean age:  $63 \pm 11$  years, 33 female) with left ventricular ejection fraction  $< 40\%$  of ischemic origin were evaluated by means of gated SPECT with technetium labeled compounds (156 stress-rest test and 50 rest test). Eighty-four percent of them had previous myocardial infarction (96 anterior, 56 infero-lateral and 14 no Q infarction). Absence of scintigraphic myocardial viability criteria (no ischemia, uptake at rest  $> 30\%$  and/or no systolic thickening in more than 3/17 segments) of the regions with severe hypokinesia, akinesia or dyskinesia were analyzed. Also, coronary revascularization suitability in the coronary angiography was evaluated.

**Results.** There were 59 patients without scintigraphy viability criteria: 39 out of 156 without ischemia in stress-rest SPECT, 68/206 without  $< 30\%$  uptake and 76/206 without systolic thickening in more than 3 segments in rest gated-SPECT.

#### Results Table

Fifty-one percent of the patients with myocardial viability were not revascularized (40 with inadequate coronary anatomy, 6 high risk, and 8 rejection) and 30.5 % of the non-viable patients were revascularized due to the presence of ischemia in other regions. PTCA was more frequent in non viable patients with ischemia at a distance.

**Conclusions.** In 51% of the patients who showed myocardial viability in the gated SPECT and who were studied with coronary angiography were not revascularized, mainly due to an inadequate coronary anatomy. A third of the patients without viability criteria were revascularized due to the presence of ischemia in other regions.

Results Table

	Viable Patients (n=147)	Non-viable patients (n=59)	p
Coronary angiography	105 (71.4%)	45 (76.3%)	0.48
Revascularization	51 (34.7%)	18 (30.5%)	0.565
PTCA/CABG	8 (15.6%)/43 (84.3%)	7 (38.8%)/11 (61.1%)	0.04

## 5.55

### Quantitative gated SPECT interassay reproducibility in atrial fibrillation.

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Aim of the study. Interassay reproducibility of gated SPECT for the evaluation of left ventricular volumes and ejection fraction is high in patients with sinus rhythm, but it has not been studied in the presence of atrial fibrillation (AF). Therefore, the aim of this study was to evaluate the interassay reproducibility of this technique in the quantification of left ventricular end-diastolic volume (EDV), end-systolic volume (ESV), and ejection fraction (EF) in patients with AF.

**Methods.** Forty patients (mean age:  $69 \pm 7$  years, 13 women) with atrial fibrillation were studied by means of two day stress-rest gated SPECT with  $^{99m}\text{Tc}$ -labeled compounds. Two rest gated SPECT acquisitions (1st g-SPECT and 2nd g-SPECT) separated more than 30 minutes were acquired. The quantitative values (EDV, ESV, and EF) were obtained using the QGS® method. Correlation, linear regression, and variation coefficient between the first and second gated SPECT were evaluated.

**Results:** Mean values of ventricular volumes and EF, variation coefficient, and analysis of Pearson correlation and linear regression were obtained:

Results Table.

A good correlation and lineal regression were obtained. The variation coefficient for EF was three times greater than in patients without AF, and two times greater for ESV (Interassay variability of EF was  $2.0 \pm 5.1$  ( $r=0.94$ ), EDV was  $4.5 \pm 8.6\%$  and ESV was  $3.4 \pm 6.6\%$  ml, in patients without AF in our nuclear cardiology department).

**Conclusions.** Interassay reproducibility of the gated SPECT in the determination of left ventricular volumes and ejection fraction is acceptable even in the presence of atrial fibrillation.

Results Table

N = 40	EF %	EDV (ml)	ESV (ml)
g-SPECT 1st	$57.9 \pm 13.1$	$90.1 \pm 43.9$	$41.1 \pm 31.3$
g-SPECT 2nd	$55.8 \pm 11.6$	$93.2 \pm 43.5$	$43.8 \pm 29.8$
Pearson correlation	$p < 0.000$	$p < 0.000$	$p < 0.000$
Linear regression	$r = 0.91$	$r = 0.99$	$r = 0.99$
ANOVA test	$p < 0.000$	$p < 0.000$	$p < 0.000$
Variation coefficient	6.4 %	5.2 %	8.4 %

Mean  $\pm$  SD

## 5.56

### Left ventricular function and phase analysis with equilibrium radionuclide angiography in patients with biventricular pacemaker. Preliminary results.

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Resynchronization pacing with a biventricular pacemaker has been added to conventional advanced heart failure treatment, in order to improve functional class in these patients.

**Aim:** To evaluate left ventricular ejection fraction (LVEF) changes and resynchronization in patients with advanced heart failure after a biventricular pacing implant.

**Material and method:** The study group consisted of 50 patients (41 men and 9 women, mean age  $69 \pm 8$  years) with advanced heart failure. Twenty-five patients had a dilated cardiomyopathy and the remaining 25 were ischaemic.

An equilibrium radionuclide ventriculography was carried out following standardized techniques, 72 hours after the implant. Two acquisitions were performed; one with the pacemaker connected and a second after disconnect the pacemaker.

At 6 months a control study was also made and responders were defined as those who were alive, had not received a heart transplant and achieved more than 10% increase in distance in the 6 minute-walking test. Changes in LVEF and resynchronization (according to the phase analysis) were studied comparing the connected and disconnected modes and also comparing the basal and the 6 months studies.

**Results:** LVEF increased significantly at 6 months both with the pacemaker connected ( $23.38 \pm 11.47$  vs.  $27.06 \pm 13.57$ ,  $p < 0.003$ ) and with the pacemaker disconnected ( $22.84 \pm 10.42$  vs.  $26.65 \pm 13.42$ ,  $p < 0.001$ ), compared to the basal study. Moreover, a significant improvement in LVEF was found at 6 months with the pacemaker connected compared to the disconnected basal study ( $27.06 \pm 13.57$  vs.  $22.84 \pm 10.42$ ) ( $p < 0.001$ ). In the basal study, after disconnection of the pacemaker, a synchronisation worsening was found in 11% of responder patients vs. 30% of non-responder patients.

**Conclusions:** Equilibrium radionuclide angiography in patients with biventricular pacemaker shows an statistical LVEF improvement. In the basal study, resynchronization worsening after disconnect the pacemaker may predict the lack of response.<sup>o</sup>

## 5.57

### Impact of revascularization strategy on long-term prognosis in patients with chronic ischemic left ventricular dysfunction.

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**Background:** The relative benefits of coronary artery bypass graft surgery (CABG) versus percutaneous transluminal angioplasty (PTCA) in patients with chronic ischemic left ventricular (LV) dysfunction (LVD) are largely unknown.

**Aim:** To assess the impact of revascularization strategy on long-term prognosis in patients with LVD.

**Methods:** We assessed the follow up (f/u) of 102 patients with chronic ischemic LVD who underwent FDG and NH3 PET scan for assessment of hibernating myocardium (=NH3/FDG mismatch). Patients were grouped according to the presence (hibernating) or absence of viable myocardium (no hibernating).

**Results:** see table 1

**Conclusion:** Our results demonstrate a strong association between CABG and increased first year mortality compared to PTCA in the absence of myocardial viability assessed by PET. The long-term follow up, however, reveals a markedly reduced survivors rate in CABG compared to PTCA irrespective of presence or absence of viable myocardium.

Table 1.

	Hibernating CABG	Hibernating PTCA	No Hibernating CABG	No Hibernating PTCA
n	29	21	27	25
age, years	59±9	56±13	64±9	65±7
gender, male	86%	86%	78%	88%
LVEF (%)	33±11	28±9	30±7	35±3
3-vessel disease (%)	93%	62%	44%	48%
mean f/u, years	4.2±2.4	4.9±2.5	4.4±2.6	4.6±1.6
first year mortality	13.0%	13.2%	20.0%	6.0%
survivors, end of f/u	51.4%	71.8%	49.4%	80.4%

## 5.58

### Ischemia in diabetic patients without known coronary artery disease.

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**AIM:** Coronary artery disease (CAD) is the leading cause of mortality and morbidity in patients with diabetes mellitus and these patients have an elevated prevalence of silent myocardial ischemia.

The aim of this study is to compare the prevalence of inducible ischemia in symptomatic and asymptomatic patients.

**MATREIEL ET METHODE:** We studied 40 consecutive patients, with at least five years history diabetes mellitus without history of myocardial ischemia or evidence of previous myocardial infarction represented on ECG.

Rest and stress myocardial perfusion were evaluated qualitatively by two experimented and independent observers.

**RESULTS:** Our 40 patients were equally divided between males and females.

The mean age was 58 years. 38 were diabetic type II.

23 patients were symptomatic of typical angina (12 cases), or atypical chest pain (11 cases).

17 patients were absolutely asymptomatic.

The myocardial perfusion scintigraphy was positive (reversible hypo perfusion or irreversible hypo perfusion) in 91% of cases in symptomatic patients and in 64% of cases in asymptomatic ones.

30% of the diabetic patients with CAD (26% of symptomatic and 35% of asymptomatic patients), have been diagnosed only by the myocardial perfusion scintigraphy.

**CONCLUSION:** The perfusion SPECT is potentially useful in assessing CAD in patients with diabetes mellitus, especially in asymptomatic cases when the other investigations are negative.

## 5.59

### Diagnostic accuracy of Tc-99m MIBI gated SPECT for the detection of silent myocardial ischaemia in hemodialysis patients: comparison with risk factors.

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Although coronary artery disease (CAD) is a major cause of mortality and morbidity in patients undergoing hemodialysis (HD), there is no accurate diagnostic test to detect myocardial ischaemia. The aim of this study is to assess the diagnostic accuracy of Tc-99m MIBI gated SPECT for the detection of silent myocardial ischaemia in HD patients and correlate results with laboratory and clinical risk factors.

**Patients and methods:** 31 Asymptomatic patients undergoing HD (20 men, 11 women) with a mean age of 45 (range: 25-75) were included to the study. Serum electrolytes, creatinine, homocysteine and adhesion molecules were measured prior to dialysis. Ambulatory blood pressure, carotid intima media thickness measurements, echocardiography and gated Tc-99m MIBI myocardial perfusion scintigraphy (MPS) were performed in all patients. Coronary angiography (CA) was performed in those with myocardial perfusion defect and/or reduced left ventricular ejection fraction.

**Results:** gated-MPS results were abnormal in 9 (29%) patients. 6 of these patients had greater than 50% obstruction involving one or more coronary arteries on CA. There were significant differences between patients with perfusion defects (group A) and those with normal MPS (group B) regarding carotid intima media thickness, serum levels of adhesion molecules and markers of inflammation. All of these variables were higher and the duration of HD was significantly longer among patients in group A (132±89 months vs. 59±60 months p<0.05). The follow-up period lasted 20 months (range: 14-28). In group B, one patient was admitted to the hospital for severe angina pectoris whereas in group A 7 patients sustained cardiac events. The time between MPS and cardiac event varied from 1 to 13 months. Logistic regression analysis showed that quantitative MPS results (summed stress score) was significantly related to cardiac events; (odds ratio: 20, p=0.003, CI: 95%). The prevalence of cardiac events was significantly different among groups A and B (75% in group A and 13% in group B, p<0.01). The echocardiographic findings did not differ significantly between two groups.

**Conclusion:** in asymptomatic HD patients, duration of HD, inflammation, elevated serum adhesion molecules account for the increased incidence of CAD. Gated MPS is a safe and non-invasive screening test for the detection of myocardial ischemia in patients with high risk. The discordant results (perfusion defect/normal coronary angiography) can be attributed to endothelial dysfunction and abnormal vasodilatation capacity of the coronary circulation.

## 5.60

### Detection of early diastolic dysfunction in patients with left ventricular hypertrophy using 16-frame gated myocardial perfusion SPECT.

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Diastolic function (DFx) is known to deteriorate before systolic function (Sfx) in left ventricular hypertrophy (LVH) and its early diagnosis and treatment may improve outcomes. Assessment of DFx using 16-frame sestamibi myocardial perfusion SPECT (MPS) has been described, with time to peak filling (TTPF) proving the most stable DFx parameter in normals when MPS is acquired without "bad-beat rejection." To explore DFx in patients in whom abnormality is expected, we compared its assessment in 30 pts with LVH (mean age 60±12) to 30 age-matched controls (mean age 57±8). None of the patients in the control group had hypertension, diabetes or known cardiac disease. There was no significant difference in Sfx parameters between groups with end-diastolic volume (EDV), end-systolic volume (ESV) and ejection fractions (EF) being 120 ± 35 ml and 112 ± 18 ml, 52 ± 21 ml and 44 ± 10 ml, 58 ± 8 % and 61 ± 4 % in LVH group and the control group, respectively (p=non-significant for all). However, DFx was worse in LVH group as measured by TTPF, which was 223 ± 86 ms in the LVH and 160 ± 18 ms in the controls (p<0.0005). Although peak filling rate (PFR) was lower in LVH group (2.2 ± 0.7 EDV/s) compared to controls (2.3 ± 0.3 EDV/s), the difference was not statistically significant. The higher value of mean heart rate (HR) in LVH group might have influenced PFR, causing falsely "normal" values similar to control group. In 7 patients in the LVH group with repolarization abnormality on ECG, DFx was found to be even lower (mean PFR 1.9 ± 1.1 EDV/s and TTPF 256 ± 99 ms).

Our study shows that the detection of DFx abnormality is feasible with 16-frame gated MPS in patients with LVH and normal perfusion and Sfx. Although an adjustment for age, Sfx parameters and HR is needed for the accurate assessment of PFR, they are not necessary for TTPF in the detection of abnormality. TTPF appears to be a stable parameter to evaluate the DFx abnormality in gated MPS, which without adjustment shows differences between patients with LVH and normals. Thus, it is a reliable parameter to evaluate the DFx abnormality in gated MPS. The findings, in conjunction with previous studies in normals, suggest that this parameter may provide useful clinical information in assessing DFx, even in studies acquired without "bad-beat rejection."



## 5.61

### Usefulness of low dose dobutamine and nitrate Tc99m-MIBI gated SPECT in the evaluation of myocardial viability.

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**Objective:** In evaluation of myocardial viability, determination is less accurate than its reality in the studies of 99mTc-MIBI than studies of 201Tl and PET are compared. Recently owing to several methods have improved in order to increase the usefulness of 99mTc-MIBI, the underestimate situation can be decreased with carrying out quantitative analysis, nitrate and dobutamine. However, limited information is available about combination of low-dose dobutamine and nitrate-enhanced Tc99m-MIBI gated SPECT. Aim of the study was to evaluate the diagnostic potential of the combination of both low-dose dobutamine and nitrate on Tc99m-MIBI gated SPECT in detection of myocardial viability.

**Material and Methods:** The study included 21 patients with acute MI admitted to critical care department, Osmangazi university. Ten patients were males, 11 females, with a mean age of 52±4 years. MI was anterior in 15 and inferior in 6 patients. Patients with previous MI were excluded.

Rest and combination of both low dose dobutamine and nitrate Tc99m MIBI gated SPECT were performed within 1 week after AMI. A dual-head gamma camera with high-resolution collimators and a 15% window centered on the 140-keV photopeak of technetium-99m was used. SPECT was performed with 32 projections over a 180° elliptical orbit at 45 s/projection, 64 × 64 matrixes, 8-frames/cardiac cycle. The studies were reconstructed using filtered back-projection without attenuation or scatter correction.

The reconstructed slices were realigned along the heart axis and short-, horizontal long-, and vertical long-axis views were obtained. For tracer activity quantification, the gated SPECT images were summed, obtaining a standard perfusion study. The regional perfusion, left ventricular ejection fraction (EF), end diastolic and end systolic volumes (EDV, ESV), volume (V), stroke volume (SV) and extent score (ES) were assessed rest and after combination of low-dose dobutamine and nitrate 99mTc-MIBI Gated SPECT

**Results:** The findings of Tc99m-MIBI Gated SPECT imaging following the administration of low dose dobutamine and nitrate and the rest Tc99m-MIBI Gated SPECT findings revealed that while the levels of EF (p<0.05) increased significantly, there was a significant decrease in EDV (p<0.05), ESV (p<0.05), V (p<0.05), SV (p<0.05) and ES (p<0.001) values.

**Conclusion:** These results suggest that the combination of dobutamine with nitroglycerin 99mTcMIBI gated SPECT may be adequate alternative to low-dose dobutamine test for evaluation of myocardial viability and provides useful information of myocardial perfusion and function.

## 5.62

### Is stress-only technetium-99m-tetrofosmin SPECT imaging feasible when a one-day stress-rest protocol is used?

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**Background.** In myocardial perfusion scintigraphy (MPS), a normal stress study obviates the resting study. This is an advantage of a stress-rest order when a one-day technetium-99m protocol is used, but it may be impractical for the reporting physician to review every stress acquisition prior to the resting injection. We investigated whether technologists can identify a significant number of normal studies from a stress acquisition alone.

**Methods.** Four technologists (one experienced) and a consultant cardiologist scored 200 consecutive stress-only technetium-99m-tetrofosmin (250MBq) SPECT acquisitions with access to clinical and exercise ECG data (1/2= normal, no reinjection required; 3= probably normal with artefact, reinjection required; 4/5= abnormal). Scores were compared with the final clinical report based on stress and gated resting acquisitions.

**Results.** Clinical indications were diagnostic 85, post acute coronary syndrome 23, post angiography 30, post revascularisation 62. 111 studies were normal and 89 were abnormal. The readers each identified up to 30% of patients as not requiring a resting injection (Table). None of the patients so identified by the two most experienced readers turned out to have abnormal studies, though the less experienced technologists made occasional errors.

**Conclusion.** Technologists can identify a significant number of patients as having normal MPS from the stress acquisition of a one-day technetium-99m protocol. Such patients could be sent home without a resting study, saving patient and gamma camera time, and reducing radiation exposure by a factor of four. Less experienced technologists would make occasional errors, but these would be identified at the time of reporting, allowing relevant patients to be recalled for a resting study with only minor inconvenience.

**Table**

	Consultant	Experienced Tech (1)	Tech (2)	Tech (3)	Tech (4)
Total not requiring resting injection	59	57	62	31	47
Number abnormal on final report (%)	0 (0%)	0 (0%)	3 (5%)	1 (3%)	4 (9%)

Patients identified as not requiring a resting injection who turned out to have an abnormal study

## 5.63

### Myocardial perfusion scintigraphy using exercise stress is compatible with an efficient, high-volume service.

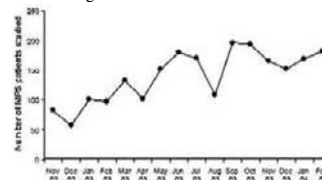
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**Background.** Dynamic exercise is the optimal form of stress in myocardial perfusion scintigraphy (MPS), providing prognostically important exercise indices and optimal imaging when a technetium-99m tracer is used. An increasing number of centres now use exclusively pharmacological stress "for convenience". We report our experience using treadmill exercise to provide a high-volume MPS service since moving into a new department.

**Methods.** A one-day stress-rest technetium-99m-tetrofosmin protocol is employed, with a dedicated cardiac gamma camera. Currently, 9 patients are stressed each morning, supervised by a nuclear cardiologist and radiographer. Patients are prepared by a radiographer assistant with electrodes and a cannula before entering the in-house stress room.

**Results.** 833 patients underwent MPS over a period of 7 months (November 2002 to June 2003). 562 (68%) were stressed using treadmill exercise, 136 (24%) using the modified rather than the full Bruce protocol; 261 (31%) required adenosine, and 4 (<1%) dobutamine. 79 of 210 (38%) patients referred for MPS due to complete inability to perform an exercise ECG were successfully exercised. Mean exercise time was 8.0±2.9min; 508 (90%) patients exercised maximally. Over the study period, monthly MPS activity increased progressively from 58 to 162 patients, and this level has been maintained (Figure).

**Conclusion.** The majority of patients referred for MPS can be stressed using dynamic exercise. With an appropriate system in place, more than 2000 patients per year can be studied during office hours on a single cardiac gamma camera. Exercise stress is fully compatible with an efficient high-volume service.



Monthly MPS activity

## 5.64

### Perfusion myocardial scintigraphy: experience in the massively obese patient.

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**Introduction:** Myocardial perfusion imaging (MPI) in the massively obese patient (MOP) is an increasingly frequent problem. Limited data is available from the literature on this select group. We review and characterize our experience with MPI in the MOP.

**Methods:** We reviewed the medical records of a large cardiology practice to identify patients categorized as MOP, body weight greater than 325lbs. Analysis of MPI studies were performed and follow-up defined. Comparison to subsequent cardiac cath was correlated to define test sensitivity, accuracy and normalcy rates. MOP were compared to non-obese controls.

**Results:** From more than 80,000 patients, 900 were identified as MOP or < 1.1%. Of this group, 115 patients had MPI (12.8%); 35 female, 80 male, with a mean age of 49.9 ± 8.9 years, significantly younger than controls: 60.1 ± 11.2 years (p < 0.05). Mean body weight of MOP was 356 ± 27.8 lbs. (range: 325-433 lbs.) vs. 200.9 ± 50 lbs. in the control group. Mean body surface area was greater in the MOP than in controls (2.69 ± 0.16m<sup>2</sup> vs. 2.06 ± 0.29m<sup>2</sup>, p < 0.05). Obese patients were taller than controls, 5'10" ± 4.5 inches vs. 5'7" ± 4 inches. Comparing MOP to controls, ejection fraction (52.2 ± 11.6 vs. 64.8 ± 8.9%), and end diastolic volume (138.9 ± 83 vs. 74.28 ± 25.6 ml) were significantly different. MOP were studied with adenosine in 78.2%, with dobutamine in 6.9%, and with exercise in 14.8%. 49 out of the 115-perfusion studies were considered abnormal (42.6%). There were no significant differences in age (49 ± 8.6 years vs. 50 ± 9.6 years), weight (359 ± 26 vs 354 ± 29 lbs.), ejection fraction (50.6 ± 13 vs. 53 ± 10), or lung heart ratios (0.46 ± 0.11 vs. 0.50 ± 0.12) in the abnormal studies vs. normal studies in MOP. By cath 20 were true positives and 29 were false positive. 66 studies were normal, only 2 of which were cathed: one true negative, one false negative. None of the remaining 64 normal studies were submitted to diagnostic heart cath (97%). The mean follow-up of normal studies in MOP was 8.9 ± 3.4 months with no angina, myocardial infarction of sudden death being identified. The sensitivity for MPI in the MOP was 95%, accuracy 73.9%, normalcy rate 69%, positive predictive value 40.8%, negative predicted value 98%. Specificity was low but only 2 of 66 patients (3%) with normal MPI were cathed.

**Conclusion:** MPI in the MOP is a challenging problem with high sensitivity but with limited specificity. Techniques to improve test specificity are needed in the MOP.

## 5.65

### Extracardiac abnormalities on myocardial perfusion imaging.

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**AIM:** This study was aimed to determine the frequency and clinical relevance of incidental but significant noncardiac findings (NCFs) detected on inspection of raw rotating projection data of single photon emission computed tomography (SPECT) perfusion imaging for the evaluation of known or suspected CAD.

**METHODS:** We retrospectively reviewed computer based study results of 305 patients for noncardiac findings, who underwent myocardial perfusion imaging for the evaluation of CAD. All the images were interpreted by a single observer.

**RESULTS:** Of the 305 patients, a total of 20 noncardiac findings (6%) were observed in 18 patients: 70% were gastrointestinal abnormalities (Hepatosplenomegaly, hiatal hernia, ascitis, gastrointestinal tumors) and 30% thoracic (Breast and mediastinal abnormalities).

**CONCLUSIONS:** Incidental noncardiac findings are relatively common in patients undergoing SPECT myocardial perfusion imaging. It is prudent to diligently look for these abnormalities. These can reveal malignancies like thymoma, lymphoma, cancers of lung and gastrointestinal tract and hiatal hernias.

## 5.67

### The sagittal heart: a newly recognized heart orientation variant and its impact upon diaphragmatic attenuation artifact.

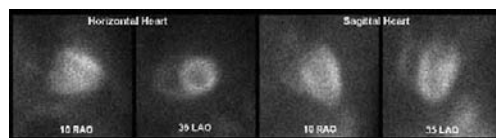
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**Introduction:** We describe an unusual, but not rare heart orientation on supine myocardial perfusion imaging (MPI). The heart appears in a longitudinal orientation in which the base of the heart lies cranially, the apex caudally. This sagittal orientation (SAG) contrasts with the more common transverse-horizontal orientation (HOZ). We postulated the SAG would impact the frequency of diaphragmatic artifact (DA).

**Methods:** 1,000 consecutive MPI were reviewed to define the incidents of SAG. Scinographic data were reviewed to identify DA. Test group variables were compared to controls.

**Results:** 56 patients had SAG (29 male, 27 female) or 5.6%. SAG patients had significantly lower mean body weight ( $69.5 \text{ kg} \pm 16$  vs.  $91.4 \pm 23$ ,  $p < 0.001$ ) and mean body surface area ( $1.79 \text{ m}^2 \pm 0.2$  vs.  $2.06 \pm 0.3$ ,  $P < 0.001$ ) than controls. There were no significant differences between SAG and HOZ in terms of age ( $63 \text{ years} \pm 14$  vs.  $60 \pm 11$ ), or height ( $70.8 \text{ cm} \pm 11$  vs.  $70.1 \pm 9$ ). Ejection fractions were greater in the control hearts ( $65\% \pm 9$  vs.  $55 \pm 16$ ), but both groups were within a normal limit. End-diastolic volumes were slightly larger in the SAG group ( $88.9 \text{ ml} \pm 45$  vs.  $74.0 \text{ ml} \pm 26$ ). SAG patients had a more scaphoid abdominal appearance compared to controls. There was significantly lower incidence of DA in SAG 4% vs. control hearts 17%.

**Conclusion:** Patients with SAG are lighter and trimmer than controls. The incidence of DA is markedly less in SAG as compared to HOZ. The reduced frequency of DA is most likely due to scaphoid abdominal configuration. In controls, the abdominal soft tissue presses the diaphragm up into the chest creating a more HOZ. Algorithms for attenuation correction should take SAG into consideration.



Planar Images: Horizontal vs Sagittal

## 5.66

### Left ventricular volume measurements with gated thallium myocardial perfusion SPECT: establishment of normal range values.

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**Introduction:** Left ventricular volume and ejection fraction calculations with gated SPECT imaging are commonly performed with Technetium as the perfusion agent. Thallium can also be used with this technique. Normal range values for left ventricular volumetrics are not available for gated Thallium imaging. We sought to establish the gender matched normal value for left ventricular volumetrics and ejection fraction using Thallium as the perfusion agent.

**Methods:** We reviewed 90 normal Thallium gated perfusion studies in low to intermediate risk patients (50 female, 40 male) to establish the expected normal range for left ventricular volumetrics and ejection fraction. AutoQuant gated software was employed to obtain the measured values. Patients with a history of previous myocardial infarction, regional wall motion abnormalities, or perfusion defects were not included in the analysis. LEAP collimators were used in the acquisition. Values are from post stress images.

**Results:** Normal males differed from normal females according to age ( $56 \pm 9$  vs.  $63 \pm 12$  yrs;  $p < 0.01$ ), weight ( $100 \pm 20$  vs.  $85 \pm 23$  kg;  $p < 0.001$ ), height ( $178 \pm 6$  vs.  $164 \pm 6$  cm;  $p < 0.0001$ ), body surface area ( $2.2 \pm 0.2$  vs.  $1.9 \pm 0.3$  m<sup>2</sup>;  $p < 0.0001$ ), and end-diastolic volume ( $90 \pm 27$  vs.  $63 \pm 17$  ml;  $p < 0.0001$ ). End-systolic volume ( $37 \pm 15$  vs.  $21 \pm 10$  ml;  $p < 0.0001$ ) and stroke volume ( $53 \pm 14$  vs.  $42 \pm 9$  ml;  $p < 0.0001$ ) were also greater in normal males compared to females. Left ventricular ejection fraction was significantly higher in females than in males ( $69 \pm 8$  vs.  $60 \pm 8\%$ ;  $p < 0.0001$ ).

**Conclusions:** We establish the normal expected range for LV volumetrics with Thallium myocardial gated perfusion imaging according to gender. The numerical values for LV volumes in men are greater than those for women, while ejection fractions are higher in women. Absolute values for LV volumetrics appear to be lower than in other imaging modalities, likely due to the resolution limitations of Thallium and SPECT. Knowledge of the normal ranges, however, should allow for appropriate interpretation in the clinical setting and for comparison in serial studies.

## 5.68

### Association of left ventricular mass and stress induced left ventricular cavity dilation in patients with normal myocardial perfusion scans.

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**BACKGROUND:** Stress induced LV cavity dilation (TID) correlates with severe and extensive coronary artery disease (CAD) and may influence adversely the prognosis associated with otherwise normal myocardial perfusion scans (MPS). However, the impact of microvascular disease associated with LV hypertrophy on TID remains undefined.

**OBJECTIVE:** To assess the relationship of left ventricular mass (LVM) and stress to rest LV volume ratios in patients with normal stress MPS.

**METHODS:** We reviewed records of 1647 patients who underwent MPS at our institution between January 1, 2002 and December 31, 2002 by retrospective query of the nuclear cardiology database. Of these, 106 patients had normal MPS (20 segment model, summed stress score  $< 3$  and summed rest score  $< 3$ ), were 18 to 85 years old, had normal echocardiographic EF ( $> 55\%$ ) and gave consent for investigative follow-up evaluation. We compared the number of patients with high and low LVM and TID with Chi-square analysis, using mean values of these variables as cut points.

**RESULTS:** TABLE 1

Of the patients with LVM  $> 225$ , 66% had evidence of TID compared to 34% in patients with LVM  $< 225$  (chi-square = 10.8,  $p = 0.001$ ).

**CONCLUSION:** LV mass is associated with TID calculations in patients with normal MPS. The role of microvascular dysfunction associated with LVH may influence the finding and prognostic significance of TID.

Table 1.

	TID <1.1	TID1.1
LV Mass >225(g)	17	33
LV Mass < 225(g)	37	19

Chi-square analysis of LV Mass and TIDM

## 5.69

### Impact of left anterior fascicular blocks on the interpretation of stress electrocardiograms.

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**Background:** The interpretation of stress electrocardiograms is known to be affected by conduction anomalies such as bundle branch blocks. However the impact of left anterior fascicular blocks (LAFB's) on stress electrocardiograms has not been critically assessed.

**Methods:** The databases of two nuclear cardiology centers were retrospectively studied for patients who had clinically indicated exercise nuclear stress tests over a 5-year period. Of the 10,322 patients identified, 110 (1%) had LAFB without bundle branch block, IVCD or LVH. The study cohort consisted of 33 patients (Age 66±9 yrs, 27 % F) with LAFB and 80 gender-matched control patients without LAFB. All subjects had clinically indicated angiograms without revascularisation performed within 1 month of stress tests. Chi-square analysis was done to determine the association between ischemia by conventional EKG criteria (> 1mm ST-segment depression) versus significant coronary artery disease (CAD) by quantitative angiographic criteria (greater than 70% stenoses in any major vessel) in both groups.

**Results:** For the controls vs. LAFB group, the accuracy (77.5 % vs. 45%, p = 0.004) and sensitivity (31 % vs. 9.5%, p = 0.01) were higher. There was no difference in specificity (p=ns) [see table].

**Conclusion:** Exercise induced ST-segment depression has a significantly lower sensitivity and accuracy for myocardial ischemia in the presence of left anterior fascicular blocks. Hence exercise stress testing alone is an inadequate screening tool for this population

#### LAFB Vs Controls Results

	LAFB Group A	(n = 33)	Controls Group B	(n = 80)
CAD +	CAD -	CAD +	CAD -	
EKG +	2 (6%)	0 (0%)	5 (6%)	7 (9%)
EKG -	19 (58%)	13 (26%)	11 (14%)	57 (71%)
Chi Square	P value :	0.69	P value :	0.15

## 5.70

### Improved prediction of hibernating and scarred tissue by gated myocardial perfusion SPECT analysis.

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**Hypothesis:** In deciding whether to assess viability in patients who exhibit a fixed perfusion abnormality on a rest/stress dual-isotope study (rest TL-201/stress Tc-99m-sestamibi), we hypothesized that percent wall thickening (%WT) derived from the stress scan is capable of predicting a finding of hibernating versus scarred myocardium on 24-hour redistribution scans. **Methods:** Twenty-five patients who underwent a clinically indicated dual isotope gated myocardial perfusion SPECT study, followed by 24 hour TL-201 imaging for viability assessment, were recruited if they had at least one myocardial segment with a fixed perfusion abnormality on rest-stress perfusion analysis. %WT analysis was performed on the stress sestamibi scans using QGS software (Cedars-Sinai Medical Center, Los Angeles, CA) employing a 20-step linear color scale, such that each color scale division represented a 5% increment in wall thickening. %WT was tabulated based on the number of color transitions from diastole to systole. %WT values in segments that showed evidence of significant redistribution on 24 hours scans, consistent with hibernating myocardium, were compared with thickening in segments that failed to redistribute, consistent with scar.

**Results:** Myocardial perfusion redistribution of activity was absent in 15 subjects and present in 10. Overall, 88% of cases were correctly characterized by logistic regression analysis of %WT values (chi-square=22.2; df=1; p<0.0001), and ROC analysis yielded 94% accuracy (95% confidence = 78%-99%), with sensitivity = 70% and specificity = 100% (see Table).

**Conclusions:** Analyses of regional % wall thickening on stress scans using gated myocardial perfusion SPECT can differentiate between hibernating myocardium and scar. This approach might be useful in guiding decisions as to whether to bring patients back for a 24-hour scan to assess viability after a dual isotope stress myocardial perfusion study or not

#### myocardial redistribution activity

	%WT = 0-5%	%WT = 6-10%	% WT > 11%
Redistribution -	9	6	0
Redistribution +	0	3	7

## 5.71

### Post-exercise and adenosine blood clearance and myocardial count density characteristics of Tc-99m sestamibi and Tc-99m tetrofosmin.

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**Background:** Because myocardial extraction of Tc-99m sestamibi (mibi) at maximal coronary blood flow rates is known to differ from that of Tc-99m tetrofosmin (tetro), we postulated that post-stress blood clearance rates and myocardial count density may likewise vary. **Methods:** Post-stress blood clearance was evaluated by means of sequential venous blood sampling for 6 min. post-injection in 20 patients (pts) receiving mibi [10 exercise (ex), 10 adenosine (adeno)] and 20 gender- and age-matched pts receiving tetro [10 ex, 10 adeno]. Ex pts were injected with tracer at peak treadmill ex, which was then continued for 1.5 min. Adeno pts were injected after a 3 min infusion, which was then continued for another 3 min. Also, to evaluate the consequences of differences in post-stress blood clearance, the stress/rest maximal count density ratio (S/R) was measured in reconstructed tomograms in 125 pts receiving mibi (54 ex, 71 adeno) and 125 receiving tetro (54 ex, 71 adeno) for a single-day, 9 mCi rest/ 36 mCi stress protocol. **Results:** The mean time from maximal to 50% blood concentration (T<sub>1/2</sub>) was longer for tetro than for mibi for ex (4.46 vs. 2.76 min, p=0.04) and for adeno (7.53 vs. 5.23 min., p=0.02). In all pts adeno T<sub>1/2</sub> was longer than ex T<sub>1/2</sub> (6.44 vs. 3.61 min, p=0.04). The mean S/R ratio was lower for tetro than for mibi with ex (3.69 vs. 4.84, p< 10-5) and for adeno (2.98 vs. 3.57, p=0.01). In all pts the adeno S/R ratio was lower than that for ex (3.38 vs. 4.33, p < 10-11). **Conclusion:** Because of delayed blood clearance the S/R ratio is lower for tetro than for mibi and lower for adeno than for ex. Therefore, for tetro vs. mibi and for adeno vs. ex there is relatively lower stress myocardial count density and consequently a greater potential for "shine-through" of resting tracer activity into the stress images, possibly decreasing sensitivity in detecting CAD.

	Tmax (min)	T1/2 (min)	S/R ratio
ex mibi			4.84
ex tetro			3.69
adeno mibi			3.57
adeno tetro			2.98

## 5.72

### Coronary calcium scoring after non-ischemic myocardial perfusion imaging studies, clinical usefulness.

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**BACKGROUND:** A number of physicians recommend coronary artery calcium scoring (CAC) in selected patients after myocardial perfusion imaging (MPI) in order to improve sensitivity for the detection of significant coronary artery disease (CAD) or, in selected patients with symptoms, to improve diagnostic confidence for the absence of significant CAD. So far, however, there is very little data to support this approach.

**METHODS and RESULTS:** We reviewed all 200 patients without known coronary artery disease who were referred for CAC by multidetector CT scanning (MDCT) shortly after MPI at our medical center. None had an ischemic MPI. There were 73 (36.5 %) men, the mean age was 53 ± 13 yrs, and 17 (8.5 %) were diabetics. The mean pretest likelihood of disease was 32.5 ± 22 % and the mean risk of developing coronary artery disease events in the next 10 years based on Framingham risk factor profile model was 11.6 ± 8.4%.

Thirteen patients, (6%) had CAC scores greater than 400 units indicating significant CAD and another 22 (11%) patients had CAC 100-400 units indicating CAD which was possibly significant. In addition, 27 patients had mildly abnormal CCS (score >10 -100) suggesting early CAD and the remainder, (n=139) had CCS less than 10 confirming no significant CAD. Traditional risk factors and patient characteristics including the presence of stress induced ECG changes or exercise induced chest pain were not significantly different between the patients with CAC score > 100 compared with those with CAC score < 100. However, the 92 patients who had detectable coronary artery calcifications (CAC > 0) were older (p=.01) and had a higher Framingham risk score (p=.002) compared with patients with CAC score = 0. With a mean follow up of 9 (± 7 sd) months, 84.5% of patients with CAC score > 100 had been given the advise to take lipid lowering therapy and 88% had been advised to take aspirin vs 44.5% and 66 % respectively of those with a CAC = 0 (p<.001 and p < .02 respectively).

**CONCLUSION:** Thus, in this series of patients who were referred for CAC scoring after non-ischemic MPI, 35/205(17.5%) were reclassified from not having CAD to having significant CAD based on a CAC score > 100. Patients who were reclassified were not easily identifiable based on clinical or stress test parameters, but Framingham risk score did predict the presence of any CAC. Clinicians appear to modify medical therapy based on the results of CAC scoring.

## 5.73

### Post-ischemic myocardial stunning: a frequent phenomenon of prolonged duration during diagnostic stress tests with positive ECG changes.

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**Objective:** To evaluate the occurrence and duration of myocardial stunning during routine diagnostic cardiac perfusion stress tests with positive electrocardiographic (ECG) changes. **Methods:** We prospectively studied 50 patients (pts.), 37 men, mean age  $66 \pm 10$  years submitted for evaluation of suspected or known coronary artery disease (CAD) with  $^{99m}\text{Tc}$  sestamibi. Stress test was exercise in 31 cases, dipyridamole in 18 and dobutamine in one. Gated SPECT was performed in the rest and post-stress period (1 hour post-injection) using a 2-day protocol. Patients having positive ECG changes with  $\text{ST} = 1.5$  mm had a second post-stress acquisition 2 hours after injection of the radiopharmaceutical. Left ventricular ejection fraction (LVEF) was determined using the QGS software package. A decrease of at least 10% in post-stress LVEF with respect to the basal (rest) value was considered positive criteria for diagnosis of myocardial stunning. Variations in LVEF were compared with the number of ischemic segments (reversible defects) observed in the perfusion images using a 20-segment segmentation model.

**Results:** Mean  $\pm$  SD values for LVEF are expressed in the table.

Twenty-five pts.(50%) presented criteria for myocardial stunning. Of those, only 6 recovered the rest LVEF value at 2 h, while the remaining 19 pts. persisted with stunning including 7 cases which demonstrated further worsening of LVEF. No significant difference was found between rest LVEF of pts. with and without stunning. In 42 pts. reversible perfusion defects were detected (ischemic pattern). Number of ischemic segments were  $2.32 \pm 1.34$  in pts. with stunning and  $1.44 \pm 1.12$  in those without stunning ( $p < 0.05$ ). No significant relationship was found between  $n^\circ$  of defects and prolonged stunning. **Conclusion:** Frequent occurrence of stunning is demonstrated in positive diagnostic stress tests, which can last up to 2 h after the test is completed.

#### Mean $\pm$ SD values for LVEF

	Rest LVEF (%)	Post-stress LVEF 1 h (%)	Post-stress LVEF 2 h (%)
Total population (n=50)	$52 \pm 8$	$47 \pm 10$ (*)	$47 \pm 11$ (*)
With stunning (n=25)	$53 \pm 7$	$42 \pm 8$ (*)	$42 \pm 10$ (*)
Without stunning (n=25)	$52 \pm 8$	$52 \pm 10$	$52 \pm 9$

(\*)  $p < 0.05$  compared to rest LVEF.